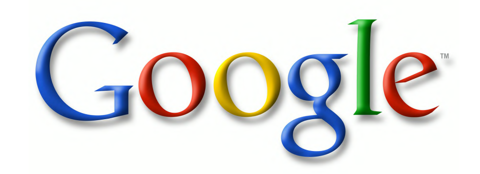
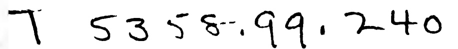


PSYCHOLOGY

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SIGILLUM ACADEMIAE HARVARDIANAE IN NOV ANG
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ESSENTIALS

OF

PSYCHOLOGY

BY

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PREFACE.

It has long been a favorite theory of the author that even the more profound subjects are capable of comprehension by the average high-school student, if presented in the simplicity of the truth. It is in accordance with this theory that this book has been prepared.

For several years it has been the author's privilege and pleasure to lead a class, varying in numbers from twenty-five to forty, through the delightful paths of psychological science. The main difficulty has been in securing a text-book that would give just what was needed, and allow at the same time that privilege which all intelligent beings should enjoy — a privilege too often lost sight of in the preparation of text-books — the privilege of doing a little independent thinking. The condensed editions of the longer treatises seemed to retain too much of the university flavor, too much of the philosophy of the subject, while for a psychology suited exactly to the needs of the normal and high school there seemed to be a growing demand. With

the intention of gratifying the author's own pupils, and many friends of more advanced age, and with the hope that in so doing he might also reach the wants of others, the preparation of this little book has been undertaken.

The author disclaims any great originality in the subject-matter. Indeed, with such writers in English in the field as James, Sully, Ladd, and many others, to say nothing of numerous German authors, originality would seem to be hardly possible. The method of treatment, the choice of the subjects treated, and the order of treatment are, however, so far as he knows, his own.

It is hoped that the style which has been adopted will meet the wants of students in high and normal schools, and at the same time will not seem too familiar for that large number of people who are anxious to learn something of Psychology in connection with their ordinary reading. The paragraphs have been arranged with special reference to the needs of the student, and the side-heads will suit his convenience in reviews, and also permit the use of the topical method.

The author has found himself constantly tempted to a fuller discussion of many topics, but, having set the limits beforehand, has rigidly held himself within bounds.

The questions and problems, some of which may seem trivial, others too difficult, will be found to render valuable assistance in attaining one of the objects of the book, the development of the psychologic faculties of the student. All these questions and problems, as well as the illustrations and examples, — which are very few in number, — are but suggestive in character, and will, of course, be supplemented by those who may use the book. Doubtless some assistance will be needed occasionally, but it should not be given until the student has failed to answer for himself; for "A man's reach should exceed his grasp."

In order that the results of independent investigations may be rendered permanent, a number of blank pages will be found at the end of the book, following the index, upon which the student may note his conclusions.

The author expresses his thanks to all those who have assisted in the preparation of this book. Especial mention should be made of Prof. William James, of Harvard, who has made several valuable suggestions, and of Dr. A. F. Blaisdell, who has kindly permitted the use of several cuts from his *Practical Physiology*.

COLIN S. BUELL.

NEW LONDON, CONN., July 27, 1898.

CONTENTS.

CONTENTS.

ESSENTIALS OF PSYCHOLOGY.

CHAPTER I.

INTRODUCTION.

DURING the last few years changes in the methods of studying Psychology have taken place, which, because of their nature and extent, have given rise to the terms "Old Psychology" and "New Psychology." It may be well for us to know, at the outset, what these terms mean.

Two Schools of Psychology.

The term "Old Psychology" is applied to the work of all the students of this science whose methods were based upon observation, introspective or external, followed by speculative reasoning, thus being more closely allied to speculative philosophy or metaphysics in many respects than to psychology proper.

Old Psychology defined.

The psychologist of the old school needed only an occasional glimpse into the outside world. He could shut himself up in his study, and, being himself both observer and observed,

Methods of Old Psychology.

could spin his theories upon the nature of mind and the causes of its peculiar phenomena, undisturbed by the fact that other minds in the busy world without might not agree at all, either in the phenomena or in the results of his deliberations upon them. Being thus shut in, he gradually formed a cult all by himself, using his own methods and his own peculiar forms of expressing his ideas. As a result, this most interesting of all sciences became a sealed book to common people, who could not spare the time necessary to master the vocabulary and the intricacies of psychological speculation.

Results of the methods.

The "New Psychology," on the other hand, is the term applied to the science as developed by means of accurate investigations and measurements.

New Psychology defined.

The psychologist of the new school takes nothing for granted. His study is a workshop and laboratory combined, wherein may be found numberless delicate and costly instruments for testing and measuring the intricate processes of minds, both those of human beings and those of the lower animals. His results are expressed in the language of the common people. He is all the time in search of new material, and any person who visits his workshop is liable to be made the victim of some kind of experiment.

Methods of New Psychology.

These delicate and costly machines would seem to be as effective in excluding common mortals from the study of this subject as were the methods of the old school. It is quite possible, however, to make use of the methods of the "New Psychology" in performing experiments within the reach of all, the results of which experiments will serve to elucidate principles, even though lacking the absolute accuracy to be obtained only in the extensive laboratory.

Practicability of new methods for common students.

We must not imagine that, because there is a "New Psychology," the old is therefore obsolete and valueless. The results obtained by the old methods are remarkable, and, though lacking the accuracy of modern research, are still very valuable. In the following pages we shall find it necessary to use some of the material furnished by the "Old Psychology," but shall hope to be able to translate it into simple, comprehensible terms.

Old Psychology still valuable.

Method of this work.

The word Psychology is derived from two Greek words, ψυχή meaning *soul*, and λόγος meaning *science*, the word soul being understood to include all the mental endowments of the human being. Make a working definition of Psychology.

Psychology defined.

The need and value of the study of this science become perfectly apparent when we consider that there

are few people who arrive at maturity who have nothing to do with the rearing and education of children. The most important and valuable part of a child is his soul equipment, and it becomes necessary for those of us who are to be in any way responsible for that equipment to know something of the processes and laws of mind development.

Need and value of study of Psychology.

Parents and teachers especially should be well acquainted with psychological laws, for they are directly responsible for the children under their care, and a mistake made when a child is young is often irreparable. That the matter has received too little serious consideration is attested by the condition of children of all ages in almost every community.

For parents and teachers especially.

But we should not study psychology only that we may know something of the proper methods of training children. It has a more immediate interest for us, in that it should help us to know ourselves better, and in this way it should lead us on toward the great end of all education — self-control. Let us bear this fact in mind, and let us judge of the value of the study to us by its effect upon our own mental development.

More immediate interest.

Let us now consider for a moment the methods by which we may study the human mind. The most

obvious method is by carefully observing the actions of others. The states and acts of the mind show themselves more or less clearly in physical actions, and by observing these actions we may get at the mind behind them. We commonly speak of our friends as looking sad or happy, as assuming attitudes of attention or being wrapped in reverie or profound thought. All these acts and attitudes are indications of what is passing in the mind, being the physical expression of the mental state. It is necessary to note, however, that there may be several sources of error in our observations, and we shall need to be constantly on our guard against them.

Methods of studying mind.

I. Observation.

Errors in observation.

Among these errors may be mentioned, first, *our own imaginations*, which are apt to color and distort the phenomena observed according to the natural tendency of our own minds. For example, call upon one of your young woman friends who is the fond mother of her first child. Observe the movements made and the sounds uttered by the infant. You will not need to ask the mother to explain these things, but you will doubtless find that her interpretations hardly agree with yours.

(1) Our own imaginations.

If you are fond of children and your friend is not, it may be of interest to notice the difference in the terms

used when speaking of the little ones. That is to say, our *prejudices* will often lead us into error.

(2) Prejudice.

A third source of error lies in the fact that *nothing is easier than to deceive the senses.* We often say that "seeing is believing," which might be true if we could only really see. Visit the police court and listen to the evidence. Is it possible that all these witnesses, who flatly contradict one another under oath, are perjurers?

(3) Senses easily deceived.

Next to this method of observation, which is so liable to error, comes the method of scientific experiment. When we wish to find out any particular fact about the mind, we may be able to bring about the right conditions, and then, by accurate measurements, obtain the results for which we are seeking.

II. Scientific Experiment.

A third method is the introspective method. This is the method commonly used by the old-school psychologists who make their own minds the object of observation and study.

III. Introspection.

Still a fourth method may be mentioned. We may study mental phenomena in connection with our reading. Indeed, though we cannot perform experiments upon the characters portrayed in books, we shall certainly find the study of literature from the psychological point of view to be far more interesting and helpful than from any other.

IV. Reading.

We should constantly bear in mind, however, that in all our study of Psychology we have nothing to do with the material or immaterial nature of the mind. That subject may be safely left to the metaphysicians. They may decide that mind is nothing but the physical disturbance of the molecules of the body produced by its contact with the outside world, or that it is the result of a chemical combination of particles of matter, or some other equally plausible physical result. Whatever their opinions, supported by arguments no matter how unanswerable, the mind, fortunately for us, will continue to work in the same old way, and to produce the same results. It is the phenomena of mental action with which alone we are concerned.

Psychology does not deal with nature of mind,

but with phenomena.

Whatever may be the nature of mind, we know that it has a close connection with and a peculiar dependence upon the physical system. It is thus related to the body in two ways: first, its condition depends largely upon the condition of the body, and its action is also dependent upon physical conditions; on the other hand, it controls and directs the body upon which it so largely depends.

Close connection between mind and body.

Seat of mind.

The seat of the human mind is the brain, which occupies the upper portion of the cavity

of the skull. The brain being shut in by the bones of the skull, some method of communication with the outside world must be established, in order that the mind may be able to gather materials for its use. No doubt the Creator might have placed the seat of mind in the ends of the fingers, but He did n't.

Means of communication with outside world.

The pioneers in psychological study said that the mind came into contact with the outside world at the surface of the body, but anatomy has given us more light on that subject. We have found that the nerves furnish the means by which materials may be carried to the mind and by which orders of various kinds may be sent from the mind. These nerves form a complete telegraphic or telephonic system with ramifications throughout the entire body, so that the mind may be readily informed of all that is going on.

Arrangement of nerves.

Nerves, as we learn from Physiology and Anatomy, are arranged in pairs. One nerve carries impressions inward toward the brain, while its companion carries an order from the mind outward toward the surface of the body. The former are called *afferent* nerves (Latin *ad*= to or toward, *fero* =carry), the latter, *efferent* nerves (Latin *ex*=out, *fero*=carry).

The nerves from the extreme portions of the body seem to be unable to carry an ordinary stimulus to the

brain without reinforcement, just as in the case of a message over the long-distance telephone; so there are found, along the lines of the nerves, reinforcing stations, clusters of nerve cells (Fig. 1), called *ganglia* (sing. *ganglion*), connected by the nerve fibers which resemble fine silk thread.

Nerve ganglia.

Some of these nerve ganglia have a limited power of

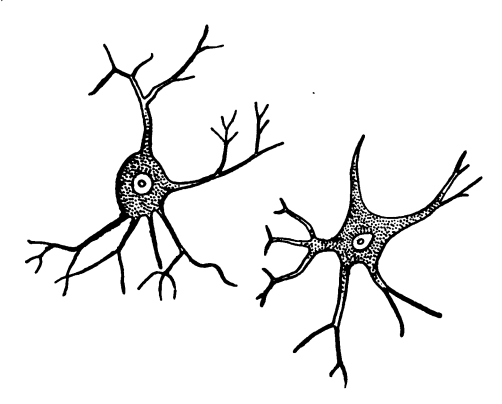


FIG. 1. Nerve cells from the spinal cord.

acting as little brains, in which capacity they govern the movements of certain portions of the body under the general supervision of the mind, very much as a city is given certain powers of home government by the state legislature, in order that the latter may be relieved from some of the minor details of government, and may thus be enabled to devote its attention to more important matters.

Special powers of some ganglia.

Actions which are governed by the lower nerve centers are called reflex. It should always be remembered, when speaking of reflex action, except in the case of the sympathetic system (explained under Medulla Oblongata), that all such action is, in the last analysis, subject to and dependent upon brain control.

Reflex action subject to brain control.

It is not within our province to go into a detailed description of the nerves and their action. It will be sufficient for us, in order that we may understand their bearing upon mental phenomena, to divide the nervous system into two parts, giving a general account of the functions of each: 1. The Central System, comprising the spinal cord, the medulla oblongata, the cerebellum, and the cerebrum; 2. The Peripheral System, which is subordinate to the central system, branching out from it into all parts of the body.

Two parts of the nervous system.

I. Central.

II. Peripheral.

The matter of the spinal cord, which is enclosed in the spinal column for the sake of protection, is made up of a central portion of nerve cells and an outside coating of nerve fibers. Nerve fibers and nerve cells are distinguished by their color, the former being white, the latter gray. The function of the spinal cord is to act as a main channel of communication between the brain and the extremities of the body.

Spinal cord and its function.

Branching off from the spinal cord are thirty-one pairs of nerves, each having a posterior and an anterior root, the posterior root being the road by which the message from the extremity reaches the cord and the brain, the anterior root being the road by which an order is sent from the brain to the extremities. These nerves have received names signifying their function in addition to the names given

Spinal nerves; their arrangement and function.

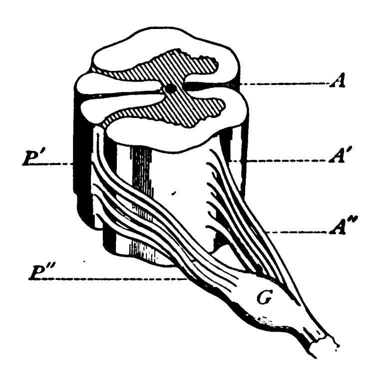


FIG. 2. Section of spinal cord.
A, anterior fissure; *A'*, anterior root; *A"*, efferent nerves; *P'*, posterior root; *P"*, afferent nerves; *G*, spinal ganglion.

them above. These names are sensory, which corresponds to afferent, and motor, corresponding to efferent.

Can you give any reason why these names are appropriate?

Problem.

If the posterior roots of these pairs of nerves should become paralyzed or should be cut, we might still be capable of performing all

Effect of injury to spinal nerves.

our customary movements, but we should be incapable of feeling pain from any injury to the portions of the body traversed by these nerves.

If, on the other hand, the anterior roots should be cut, what would be the effect upon the person?

Problem.

Thus we see how much depends upon the integrity of the spinal cord. If the cord itself is injured, all the portions of the body traversed by the nerves joining it below the injured point become paralyzed, because, the roads of communication to and from the brain being closed, the brain cannot receive sensations nor send orders.

Effect of injury to spinal cord.

Why is it that a person dies when the neck is broken? You have doubtless read of those remarkable cases where the vertebrae of the spinal column in the neck have been dislocated and yet the person has lived. Can you give any satisfactory explanation of the phenomenon?

Problems.

The upper end of the spinal cord, as it leaves the spinal column and enters the cranium, is enlarged. This enlarged portion of the spinal cord is called the Medulla Oblongata. The medulla, while not a part of the brain proper, has been endowed with a very important function in the make-up of the human system.

Medulla Oblongata.

Under its special care is placed the action of the

so-called sympathetic system, the heart and blood vessels, the lungs, and the digestive apparatus. Just think in what a critical condition we should constantly be if the action of these organs that we call vital were dependent upon

Function of the medulla.

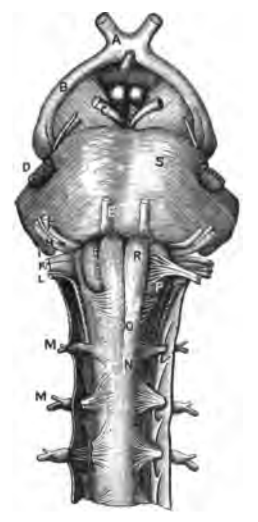


FIG. 3. Anterior view of the medulla oblongata.

A, chiasm of the optic nerves; *B*, optic tracts; *C*, motor oculi communis; *D*, fifth nerve; *E*, motor oculi externus; *F*, facial nerve; *H*, auditory nerve; *I*, glossopharyngeal nerve; *K*, pneumogastric; *L*, spinal accessory; *M*, cervical nerves; *N*, upper extremity of spinal cord; *O*, decussation of the anterior pyramids; *R*, anterior pyramids of the medulla oblongata; *S*, pons Varolii.

our thoughtfulness. Some time we might forget to breathe or to make our hearts beat, and the result would be fatal. In order that the mind may be employed in other concerns, all these matters have been

delegated to the medulla oblongata, and we can safely go to sleep without a thought of the question whether our hearts will continue to beat or not.

We may regulate to a certain extent, however, the length of our breath, and may temporarily disturb the regularity of our heart-beats; we may decidedly disturb and permanently disarrange the action of our digestive organs by eating at improper hours, or by habitually forcing those organs to work upon indigestible "delicacies."

Interference with the functions of medulla oblongata.

We have found that the power of the mind to act depends upon the condition of the body. If we wish to have strong, active minds, we should make every effort to keep the vital organs in a sound, healthy condition.

Prime condition of strong mind.

As an experiment, to show what an effect even a slight change in bodily conditions will have upon the vigor of mental action, the following may be tried. Go out into the open air and walk for fifteen minutes. As you walk, inhale the air slowly while you take six steps, exhaling for the same number of steps. Gradually increase the number of steps for each inhalation and exhalation until you have reached a dozen or fifteen. Lift the arms slowly while inhaling, lowering them while exhaling. Note the effect on the circula-

Experiment.

tion and upon your power to take up your work after the exercise.

What connection do you find between this experiment and the study of the medulla oblongata?

Problem.

We come now to the brain proper, which consists of two parts, the *cerebellum*, or little brain, and the *cerebrum*, or large brain. The cerebellum is situated in the lower, rear part of the cavity of the skull, and is divided into two hemispheres which envelop the medulla oblongata.

Cerebellum.

A peculiarity of the cerebellum and cerebrum is found in the arrangement of the substance of which they are composed. Here we find the gray matter on the outside, forming a thin coating for the white nerve fibers. This arrangement is rendered safe by the bones of the skull, and it is necessary because the gray matter needs room for growth.

Composition of cerebellum and cerebrum.

From this arrangement of the nerve matter in the spinal cord and the brain, what inference do you draw concerning the relative importance of the two kinds?

Problem.

The function of the cerebellum is to coördinate the action of the muscles. When this part of the brain is injured the person cannot control his movements. A chicken with the cerebel-

Function of cerebellum.

lum removed tumbles about with no power of self-direction. Intoxicating liquors seem to affect the cerebellum, and the result is that the person under their influence staggers.

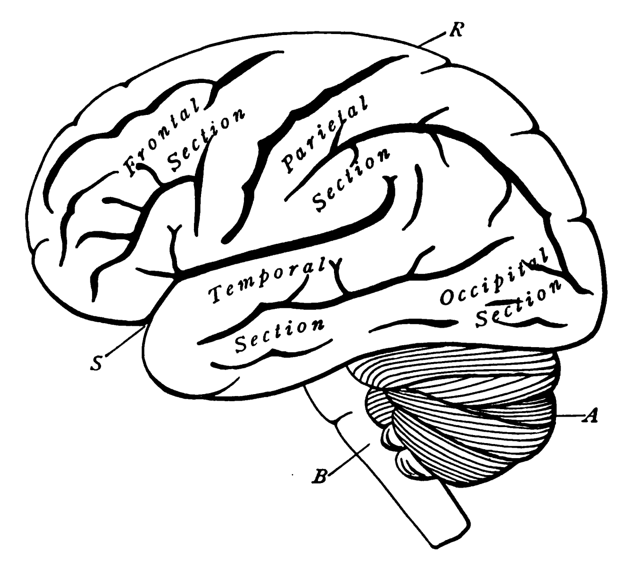


FIG. 4. Diagram (side view) showing arrangement of the cerebrum, cerebellum (*A*), and medulla (*B*).

S, fissure of Silvius; *R*, fissure of Rolando.

Cerebrum. The cerebrum, or large brain, occupies the larger portion of the cranial cavity. Its composition is the same as that of the cerebellum,—an outside covering of gray matter, called the cortex, and an inside mass of connecting white fibers.

It is divided into two hemispheres by a longitudinal fissure, extending from the front to the rear. There are also two large fissures, extending, the one from near the level of the eye backward and upward, called the fissure of Silvius, the other from near the middle of the top of the head downward and toward the front until it almost reaches the fissure of Silvius. This second fissure is called the fissure of Rolando.

Arrangement.

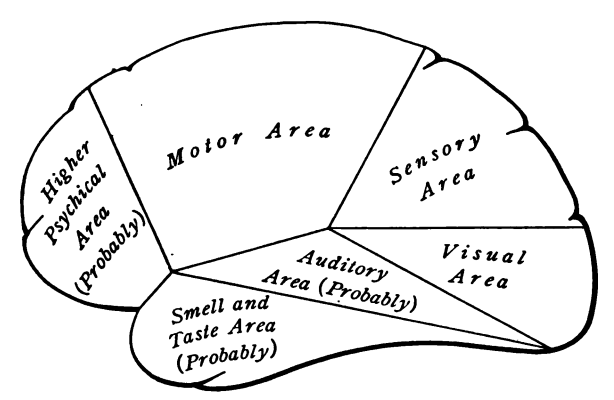


Fig. 5. Showing the principal areas of the left side of the brain.

It will be seen by referring to Fig. 4 that the hemispheres of the brain are divided by these fissures into sections, as indicated. Maps of the brain have been made, and the different physical processes have been referred to their own particular tracts, a general idea of which may be obtained from the diagram, Fig. 5.

Brain maps.

It is worth while to notice, however, that no one has yet been able to locate the place where the mind really is, where the thinking, remembering, feeling, and willing take place. That is to say, no one is as yet able to tell me just what part of the brain the *I* really occupies as headquarters.

Maps unsatisfactory.

The most interesting part of the brain is the cortex, which is composed of nerve cells estimated to vary in number from five hundred millions to two billions.

Cortex.

Recent investigations have brought to light some very interesting facts about nerve cells. If you plant a dozen peas in moist, shallow earth and place them in a sunny window and dig up one each day, observing carefully what has taken place, you will have very well illustrated what takes place in a nerve cell as we start it into action by a sense impression and then keep it active by memory, thought, etc. The result of these investigations seems to show that brain cells may be developed almost indefinitely while the brain is in a plastic condition. As they develop they keep putting out roots upon which their strength seems to depend, just as the strength of a plant lies in its roots.

Nerve cells and their development.

Problem. What would naturally be the conditions under which brain cells might be developed?

In infancy the cortex conforms to the shape of the skull. As the nerve cells develop, and their roots increase in number and size, more room is needed. The consequence is that the nerve cells, by crowding one another, push the cortex out of shape, and its surface becomes seamed and convoluted. This process of brain evolution may be carried on till the brain ceases to be plastic, a time which anatomists place at from twenty-five to thirty-five years.

Brain development.

If this is true, what effect should the knowledge of it have upon us as students? Why?

Problem.

After the growth of the brain ceases, we are told, we are practically incapable of taking up any absolutely new line of work. Our brains have formed their habits of working, good or bad, and refuse to work in new ways. A few years ago the discoveries of scientists made it plain that this earth of ours is far older than six thousand years, and that it was many centuries in the building. The people who had always been accustomed to accept the figures of early Bible students as a part of the Bible itself, and the first chapter of Genesis as literal history, could not bring themselves to accept the truth, because their brains refused to work along the new lines.

Limitations of mind power.

Not only do we become incapable of appropriating to our use new lines of thought, but we must also

keep exercising our minds along the old lines unless we wish to lose the power of using them, for the brain, just as the body, will lose power by disuse. We know that if we carry one arm in a sling it soon becomes weaker than the other, and that it will eventually lose all power unless exercised. So the brain needs exercise to develop or maintain its vigor.

Need of constant mental exercise.

Connected with these higher nerve centers is the peripheral system, nerves having their ramifications over the whole body, ending at the surface of the body, serving to set in motion the communication between the outside world and the brain. If we possessed the central system without the peripheral system, we could gain no knowledge of what is going on outside. It is this peripheral system, then, that we want to study most carefully.

Peripheral system and its value.

If the central system is in a healthy condition, it is our business to see to it that it has an abundance of material to work upon. This we can do by cultivating and educating the different end nerves of the peripheral system, or, as we generally call them, the five senses. If the five senses are all the time on the alert for raw material, we are all the time accumulating knowledge.

Need and method of furnishing the mind with materials.

In this connection, can you give any good reason for

the existence of the Kindergarten? Of what practical value are the games and stories and songs? **Problems.** In the common-school system, what is the value of drawing, of modeling, and of music?

Method of communication between mind and matter.

Let us now inquire how the connection is made between the outside world, the world of matter, and the inside world, the world of mind. When you touch your finger to any substance, as, for example, the point of a needle, a highly interesting process is set in motion. The needle point irritated the end of a sensory nerve. This irritation was telegraphed, in the form of a vibration, along the nerve fiber to the brain, where it reached its proper nerve cell. There, in some mysterious way, this impression, or vibration, was transformed into a *sensation*, the character of which was determined by the character of the touch: if the touch was light, the sensation was a tickling sensation; if hard, a painful sensation. The mind, seizing upon and interpreting this sensation, immediately sent a message to the finger-tip along the motor nerve, the companion to the sensory nerve affected, telling the finger to move away from the needle.

In the case of the lower extremities the impression may not always be carried to the brain, and we have what is called reflex action. It seems that the brain

delegates some small portion of its directive power to the lower centers, always, however, with the reservation that the brain may assume active control at any time. This is the reason why, when you have started out for a walk, it is not necessary that you should take care to direct every step. You set the body in motion and then turn your mind to anything you please. You converse with your friends, you listen to the singing of the birds, or look at the flowers and trees, and yet you are walking all the time, the movements being kept up by the reflex action of the nerve centers in the spinal cord.

Reflex action.

It should be noticed that this kind of reflex action is an acquired power. When the child is learning to walk he needs to put his whole mind into it. The balancing of the body and the movements of the limbs are the result of continued and painstaking effort. Habit renders these things easy, but after a long illness people have found themselves obliged to learn again the easy series of falls and recoveries of which true walking consists.

Reflex action acquired.

Sensations, a general discussion of which as mental phenomena may be postponed until we come to consider Perception, may, from the physical side, be separated into two classes, general and special.

Sensations, classes of.

General sensations are those that affect the nervous system as a whole, such as exhilaration, fatigue. Name others.

General sensations.

Special sensations are those excited by an affection of the end organs of the special senses. The general sensations are, to be sure, only modifications of the special sensations, the difference being that the mind fails to refer the so-called general sensations to any one of the special senses.

Special sensations.

The special senses are five in number. Their function is to receive impressions from the outside world and to send messages to the brain by stimulating the sensory nerves to action. Their importance can hardly be overestimated, since without them the mind would have no materials out of which to weave its structures of thought and imagination.

Five senses, functions and importance.

CHAPTER II.

THE SENSES—TASTE AND SMELL.

LET us now consider the five senses and their functions, in order to discover the amount of material fur-

The five senses. nished by each to the mind. We may arrange them in the order of their importance, or, since that may be a disputed point, in the inverse order of the amount of material furnished by them,—taste, smell, hearing, sight, touch.

The sense of taste furnishes the least amount of original knowledge of the world to the mind. Indeed,

Sense of taste. taste occupies a far smaller place in our experience than we are apt to suppose, as the experiments suggested in the following pages will help to show.

The organs of taste are the tongue and the soft palate. In these organs are found the "taste buds,"

Taste organs. so called because they somewhat resemble a bud in shape, which are connected with the gustatory nerve.

The sensation of taste arises when any of these "taste buds" come in contact with liquid or soluble

substances, and is doubtless due to chemical action. Only liquids or solubles can be tasted. If you attempt to taste insoluble substances you will find this to be true. Try it with glass, iron (not oxidized), etc. In trying all experiments for taste remember to stop the nose tight. Cotton stuffed into the nostrils will answer the purpose, though wax is better.

Taste is chemical action.

Pure tastes are of four varieties, sweet, sour, bitter, and salt, or combinations of these. Some authorities add alkaline and metallic tastes, but these are only combinations of taste and touch sensations.

Four varieties of taste.

Using care to stop the nose, experiment with any substances that you may have at hand. Fruits, raw potato, onion, vinegar, weak acetic acid, quinine, etc., may be tried. For the fruits, etc., scrape off a little with a knife and place it on the tongue; liquids should be administered with a glass dropper, and only a very small amount at a time.

Experiment.

All acids will be found to have the same taste, whether found in fruits or in the liquid form; quinine, almonds, etc., are bitter, the only difference being in the intensity. You will probably be surprised to learn how few substances you can name by the taste alone, unassisted by the eye or nose.

Results to be expected.

But if there are only four tastes, something must be done to explain the intensely pleasurable sensations of the epicure and, to a less degree, of every one else. The truth is that most tastes are complex, the sense of touch, and especially the sense of smell, exerting a strongly modifying influence. The sense of sight alsò exerts a slight influence upon taste. Every one knows how much better a fine-looking apple tastes than one not so pretty, and how much better a well-served and well-garnished dinner tastes than the same food without these eye inducements to the appetite.

Complex nature of tastes.

The sense of touch enters into many of the tastes, producing now an agreeable irritation, as in the case of sweet and sour substances, now a puckering of the surface of the tongue, as in salt and bitter substances.

Effect of touch upon taste.

Many things that we eat are partly volatilized in the mouth during mastication, and the vapor, ascending into the cavity of the nose, affects the sense of smell.

Smell and taste.

If you have tried the experiments with fruits suggested above, you have found that the flavors of fruits depend upon what? Are you now prepared to explain why people afflicted with cold in the head often "lose the sense of taste"? What is really lost in such cases?

Problems.

While the elements of cognition obtained through the sense of taste may be fewer than we had supposed, let us not make the mistake of thinking that the sense is of but little importance.

For each of the senses there is a point of starting and a point of vanishing, as it were, called the threshold of sensation, lower and upper. Thus we find that a certain number of vibrations of the ether is necessary to produce the sensation of sound, another to produce sensations of light, and that there must be a certain degree of strength to any solution to produce the sensation of taste.

Threshold of sensation.

For example, one part of sugar in two hundred of water will produce a sweet taste, one part of salt in twenty-five hundred of water will produce a salt taste, one of sulphuric acid in thirty-five hundred of water a sour taste, and one of quinine in five hundred thousand of water a bitter taste.

Threshold of taste.

This subject of the threshold has received a large share of the attention of psychologists recently, and almost numberless experiments have been tried in order to deduce a general law for the threshold. While it seems impossible to find such a general law for all the senses, an approximate law for the threshold of change in sensations of pressure within certain limits has been discovered.

Law for threshold.

This law takes its name from the propounder, Weber, or, since the same principle was enunciated by Fechner, it is sometimes called Fechner's law. Weber's, or Fechner's, law may be stated as follows: "To produce a change in a sensation of pressure, the stimulus which produced the sensation must be increased or diminished one-third."

Weber's, or Fechner's, law.

But it is very evident that, if an immense weight were to fall upon your foot, the sensation produced would be just as intense as though the weight were one-third greater. In other words, there is a point beyond which an increase in the stimulus produces no perceptible change in the sensation. On the other hand, one mosquito weighing one-third less than another is felt to be just as heavy as his weightier kinsman. We find, then, that the law of change in sensations of pressure as propounded by Weber is only approximately true for sensations within a certain range of intensity.

Law only approximately true.

If you wish to experiment to find the threshold of taste for any particular substance, make, or purchase at the drug store, a solution of that substance of known strength. For example, if you procure a five per cent solution, one drop of this solution will contain five one-hundredths of a drop of the pure article. If now you add

Experiment for threshold of taste.

one hundred drops of water, you can find, by a simple arithmetical calculation, the per cent of the diluted solution. Now, with a glass dropper place a little of this diluted mixture on the tongue, adding water or the solution until there is the least perceptible taste. When the greatest dilution that will produce a sensation of taste has been found, you have the threshold of taste for that substance. Of course no general rule for the threshold of taste can be made, because there is a different threshold for each substance tested. We cannot say that sugar is as sweet as vinegar is sour.

Intensity of tastes.

The intensity of tastes, as we might conclude from the last experiment, depends upon quantity. A five per cent solution does not produce so strong a sensation as a ten per cent solution; a few drops of salt water will not have the same effect as a mouthful.

Reinforcement of tastes.

One of the strangest things about tastes is this, that one taste may be made to reinforce or strengthen another of a different kind, if the reinforcing taste be very weak. Sweet sensations may be made stronger by the addition of a slightly bitter sensation, sour sensations by the addition of sweet.

Again, tastes may be modified or entirely obliterated by the effect of temperature. Take hot water into the

mouth, holding it there for a short time. If now you put a little sugar on the tongue, you will miss the usual sensations. Try the same experiment, using ice instead of hot water, and note the result. Sugar is suggested for this experiment because the tip of the tongue is especially sensitive to sweet things.

Temperature and taste experiments.

Strangely enough, different areas of the tongue and palate seem to appropriate to themselves particular tastes, and are more or less indifferent to other tastes than their own. Sweet and sour are best tasted toward the end of the tongue, salt along the sides, and bitter in the back part of the mouth. If you wanted to take a quinine pill, where would you place it in order to get the least bitter taste?

Location of tastes.

In general, we find that the knowledge material gathered for the mind by the sense of taste is quite small in amount. The tongue by its position, being placed where all food taken into the system must pass over it, seems designed to be the guardian over the nutrition of the body, passing judgment upon the suitability or non-suitability of the matter presented for passage into the stomach.

Little knowledge by taste.

* * *

Smell seems to have been intended to hold the same relation to the lungs that taste holds to the stomach. Its first business is to judge whether the air about to be received into the lungs is of standard purity or not, but the sense has been educated into a position of aesthetic importance.

Smell.

The organ of smell is the olfactory area in the cavity of the nose, and the sensation of smell is produced by inspiration, which may be intensified by sniffing.

Smell organ.

Only gaseous or volatilizable substances are capable of producing the sensation, which seems to be caused by chemical action, though the exact nature of this action has not been as yet definitively ascertained.

Smell produced by chemical action.

This sense is found much more highly developed in some of the lower animals than in man. The dog, for instance, makes use of smell, not only as an adjunct to taste and as an air tester, but also as an instrument for the purpose of discriminating friend and foe, or in discovering the whereabouts of game. The trained dog will follow a person accurately by this sense alone, with no apparent inclination to make use of the eyes and ears. Human beings cannot do this because they have learned to depend upon other senses, and have allowed the sense of smell to remain undeveloped.

Smell in lower animals.

And yet it is possible to cultivate smell to a high degree of sensitiveness, as we find in the case of tea-tasters, who can tell from what district a sample of any of the standard teas was brought by the aroma, and in the connoisseurs of wines, who can tell where any sample of wine was made and its age by this sense assisted by the senses of taste and touch.

Possibilities of smell in man.

If you care to see how sensitive the smell of the lower animals is, the following experiment may prove interesting. Procure a sprig of catmint and enter the room where puss lies asleep. Notice how long it takes her to find out that there is some unusual attraction near. No person in the room has noticed the odor, probably. It need hardly be said that cats accustomed to having mint in abundance will care nothing for it, and you will need to try some other experiment, which, I am sure, will readily suggest itself.

Sensitiveness of lower animals. Experiment.

Though there are so many odors, we really recognize but few substances by the sense of smell. An interesting experiment is found in the game that is often played. The subjects of the experiment are blindfolded and different substances are presented to their noses for test; others are placed on the tongue to be tested by taste, or by

Experiment to distinguish odors.

taste and smell combined. The correct names of the substances are supposed to be given at once. Many mistakes are made, for many odors closely resemble one another.

Because of this resemblance between odors, and because the same odor affects a person differently at different times, and may not affect two people in the same way at any time, we have to note the very peculiar fact that odors have no names. Tastes are called sour, sweet, salt, or bitter; colors are red, green, blue, etc.; sounds are accurately named, and sensations of touch as well; but odors are unclassified and unnamed, and will probably continue to remain so for a long time to come. But, you may object, we speak of sweet odors, pleasant odors, etc. Very true, but these names come from the effect of the odors upon the feelings, not from any inherent qualities in the odors themselves. To me the odor of sweet peas is not pleasant, while most people are fond of it.

Odors without names.

It is worth our while to note that we have two nostrils. Did you ever wonder why? Can you give any satisfactory reason why one nostril would not do just as well as two?

Problems.

We must believe that no part of the body is absolutely useless, and two nostrils must mean something. Let me suggest an experiment that may help you to

solve the problem. Roll two sheets of paper into funnel-shaped tubes. Tin horns will do equally well.

Experiment to show value of two nostrils.

Place the smaller ends of the tubes one in each nostril. Now place under the large end of one a bottle containing camphor, under the other a bottle of violet cologne. A rose and a geranium, or any other fragrant flowers, may be substituted for the camphor and cologne.

Problems.

Note carefully what occurs. Now what do you think about the nose as a single organ? Is there any advantage in having a double sense of smell? What, and why?

Smell fatigue.

Why does the cook not notice the odor of boiling onions? This sense may become so fatigued as not to observe odors. And yet, curiously enough, if a new odor is presented when the sense is fatigued, the sense will be found to be just as acute as ever. That is to say, the fatigue affects only the odor which is the cause of the fatigue.

Experiment.

Take a bottle of camphor or alcohol. Close one nostril and inhale with the other. You will soon find that the odor seems to be consumed. It is only by shaking the bottle vigorously that any effect can be produced upon the sense of smell. Now bring some other odorous substance near the nostril. You can smell that without difficulty.

What practical use of our knowledge about the fatigue of smell may we make?

Problem.

If we should lose the sense of smell, we should be in constant danger of suffocation, because we should be unable to distinguish poisonous gases from pure air; but aside from this physical fact, what knowledge of the outside world would our minds lose? What aesthetic enjoyment should we miss? Which sense would you prefer to dispense with, taste or smell? Why?

Value of sense of smell.

CHAPTER III.

THE SENSES — HEARING.

Hearing caused by vibrations of air.

THE sense of hearing is generally conceded to be of greater importance than either of the senses thus far considered, because it is capable of being affected at a distance by the peculiar stimulus, vibrations, or periodic motions, of the air.

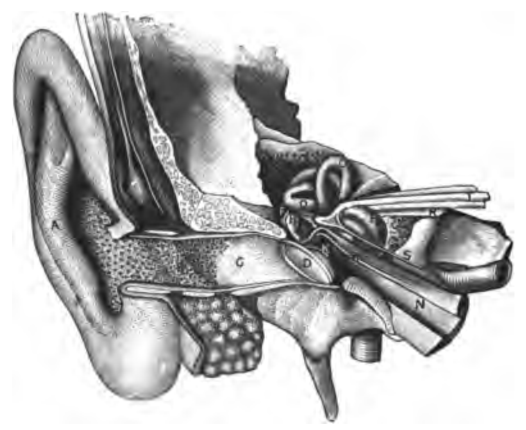


FIG. 6. General view of the organ of hearing.

A, outer ear; *BC*, middle ear; *D*, tympanum; *FHK*, inner ear, showing incus and malleus; *N*, Eustachian tube; *OP*, semicircular canals; *R*, internal auditory canal; *T*, auditory nerve.

The organ of hearing consists of three parts, the *outer ear*, which collects the vibrations and conducts

them to the *middle ear*, where they strike the tympanum, whence they are conveyed to the *inner ear*, or labyrinth, where they affect the auditory nerve. For a detailed description of the ear the student is referred to any text-book of Physiology. In the accompanying figure are indicated the important parts for us who are pursuing the study of sense-phenomena to remember.

Organ of hearing.

A great variety of sensations are produced by the vibrations of the air which enter the ear. The human ear is capable of being affected by vibrations ranging in number from twelve to sixty thousand per second, though not every ear is sensitive to all these vibrations. Besides the number of vibrations, we have also to consider the character of the vibrations themselves as proceeding from different sources.

Range of hearing sensations.

Press your finger intermittently upon the front of the ear so as to close the passage. You may produce a distinct sensation of sound. The same may be done by a sudden jar.

Sound produced by pressure.

Again, we can hear the blood rushing through the veins. Cover the ear with the hand. You hear a rushing sound which soon takes on a distinct pulsation, and if you place the other hand over the heart you will find that the pulsations

Sensitiveness of the ear.

in the ear correspond to those of the heart. When we place a sounding board near the ear the pulsation becomes much stronger and louder.

Problems. What scientific explanation of the following lines can be given?

I have seen
A curious child, who dwelt upon a tract
Of inland ground, applying to his ear
The convolutions of a smooth-lipped shell,
To which, in silence hushed, his very soul
Listened intensely, and his countenance soon
Brightened with joy; for murmurings from within
Were heard, sonorous cadences! whereby,
To his belief, the monitor expressed
Mysterious union with its native sea.

WORDSWORTH, *Excursion*, Book IV.

Those who are fond of diving know that when the water forms a bubble in the ear the rushing sound is very annoying. Can you offer any explanation?

We may try one more experiment to show the sensitiveness of the ear. The person to be experimented

Experiment. upon is blindfolded. We take for the experiment a very thin pine board, a strip of cloth, and a strip of wire net. The last two will be more conveniently handled if stretched upon frames. The operator advances the wood, cloth, and net, one after another, toward the ear of the person experimented upon, who tells which of the objects is presented. The

number of correct and incorrect answers should be recorded as furnishing a comparative measure of the sensitiveness of the ear. Some people can tell correctly nearly every time by the character of the vibrations entering the ear, while others only guess.

Noises and musical tones.

All the sounds that we are capable of hearing may be divided into two classes, noises and musical tones. But what is the difference between a noise and a musical tone? Simply the difference in the effect produced upon us. A sound that pleases us we call musical; a sound that produces an unpleasant sensation we call a noise.

Estimate of noises and musical tones depends on education.

Our estimate of noises and musical tones depends very largely upon the nature of our education. Sounds that would be called musical by the Chinese would seem almost unbearable noises to the Germans. You and I, whose musical education has not been carried to the extreme of refinement, are affected very differently from our friend whose ear has been carefully trained to detect the slightest discord. Moreover, sounds from the same source produce different effects under different circumstances. Place any musical instrument in the hands of one who does not know how to use it, and the instrument is made to give forth sounds that are anything but musical. The reason for this is what?

It is apparent to every one that sounds vary in intensity, that is, that some sounds are louder than others; in pitch, that is, that some sounds are lower, some higher than others, as the bass viol and the first violin; and in quality, which means the difference in sounds caused by the sources from which they come. For example, the difference in the quality of the sounds coming from a tin horn and from a church organ, while they may be of equal intensity and of the same pitch, may be easily detected even by the uneducated.

Variations of sounds, in intensity, pitch, quality.

Scientifically speaking, we mean by intensity the amplitude of the vibrations which produce the sound. As all sounds are produced by vibrations, we may find it interesting to experiment a little in order to find out just what takes place. A rough experiment may illustrate amplitude of vibrations or intensity of sound.

Intensity of sounds.

Stretch a violin string, a rubber band, or even a common string tight. Pull the middle of the string a little to the side and let go. Repeat, pulling the string farther each time.

Experiment.

What results do you get, and what do you take to be the cause? By holding the eye directly over the string the vibrations may be seen.

Problem.

Of course the greater the intensity of the sound the more violent is the agitation of the air. Now what would be the effect of removing the hearer **Problems.** to a distance from the sounding body? Why? How far must the hearer be removed before he will notice any change in intensity? Would it be possible to obtain a law for the threshold of change in intensity by means of experiments similar to those suggested by the last question?

You have doubtless noticed that a person playing the violin or any stringed instrument moves the fingers of the left hand up and down the strings. **Pitch of sounds.** What does he do this for? May we conclude that a short string will produce a higher tone than a long one? But what do we mean by a higher tone? A short string vibrates more rapidly than a long one, as you may prove for yourself by stretching a long and a short string just over a board on which very fine sand or meal has been sprinkled, and causing them to vibrate. We may say, then, that while intensity of sound depends upon the amplitude of vibrations, the pitch depends upon the rate of the vibrations.

The rate of vibrations that we can hear ranges between twelve and sixty thousand per second, any vibrations fewer than twelve causing nothing but a series of puffs, and any number above sixty thousand producing

no effect. But we must not suppose that every person can hear all these sounds. Many people cannot hear the lowest notes of the organ at thirty-two vibrations, while to the majority of people all sounds of more than forty thousand vibrations are inaudible. We must conclude from these facts that the limits of sound are caused by the dullness of the auditory nerve. It is, for many reasons, a distinct advantage to us that our hearing capacity is limited, for if we were able to hear all sounds caused by all vibrations up to 100,000 per second, our nerves would be in a state of chronic distraction.

Limitations of different ears.

Some animals can hear much higher sounds than men, others not so high as men. A man by the name of Galton invented a whistle which could be made longer or shorter by means of a screw-cap at the end. As the cylinder was shortened the pitch rose, and the scale could be read upon the graduated cylinder. With this whistle Galton went through the zoölogical gardens testing the hearing powers of the animals.

Hearing of animals.

Galton's whistle.

Large dogs were found to hear less readily than small ones. Why? The ears of the cat, and all members of the cat tribe, are very acute. Can you suggest any reason why the cat should be especially sensitive to sounds? Why should these animals

Problems.

be more sensitive to sounds than human beings? Keeping the traditional acuteness of the ears of the Indians in mind, do you suppose there ever was a time in the history of man when he could hear just as well as any of the wild animals? Give reasons for your answer. May we say that the ear may be trained to hear sounds of higher and lower pitch than fall within the normal scope? Why?

Sounds composite. All musical tones except that of a tuning fork, and indeed all sounds, whether musical or not, are composite in character. The tone of a tuning fork is simple. All others are made up of this simple fundamental tone, and others, which are called undertones and overtones. If these under or over tones harmonize with the fundamental, we call the resultant musical; if not, we call it noise.

Quality of sounds. It is the undertone or overtone that gives the peculiar character which we call quality. These under and over tones are caused by the material and shape of the resonant body. All substances have resonance. If you go out into a "melon patch" and snap several specimens, you will find that each will give back its own peculiar sound. Woods are full of resonance, as we find when they are made up into musical instruments. Metals, too, give back, each its own answer when struck. The human voice,

the organ, the violin, the flute, and the "corn fiddle," all have their peculiar qualities, easily distinguished by any one.

Shape of sounding body affects quality.

The shape of the sounding body has also much to do with the quality of the sound issuing from it. No one has any difficulty in detecting the difference between a horn and an instrument of any other shape — as the fife or flute — between a banjo and a violin or a mandolin.

What we learn through the ear.

These three things, then, we learn through the ear — intensity, pitch, and quality of sounds. Connected with each of these subjects, there are a great many interesting topics for investigation, topics which are of more immediate interest to the musical scientist than to us. Some of the phenomena observed may, however, be indicated as properly bearing upon mental investigations.

Deafness of the aged.

Every one knows that old people hear less readily than when they were young. Indeed, we take it for granted that old people are deaf, and raise our voices when speaking to them. As a matter of fact, most deaf people are affected only in the upper tones. They can hear tones of low pitch quite readily. A low, distinct tone is generally heard far better by deaf people than the high scream with which they are commonly addressed.

Does this fact throw any light upon the phenomenon so often observed, that deaf people are very apt to hear what is said when people are conversing in an undertone?

Problem.

Still another strange phenomenon is this, that deaf people commonly hear better in a room where there is a noise than in quiet, in a mill or on the cars than in a parlor. This is explained by what is called reinforcement, that is, one kind of sound helps to make another seem louder. The violent agitation of the air in a mill sets the tympanum of the ear in vibration. Now when another sound is presented, as of the voice in speaking, the added vibrations to which the attention is especially directed become very plainly discernible.

Reinforcement of sounds.

A person who plays on any kind of stringed instrument must be reasonably accurate in the detection of differences in tones. Though not quite so important, it is yet a matter of educational value that the ears of all young people should be trained more carefully than at present.

Accuracy in detecting tones.

Try the following experiment to ascertain whether your ear is accurate or not. Tune a stringed instrument to the exact tone of a brass instrument. In case you are unable to secure these instruments for experiments, the following is within the

Experiment.

power of any one. Stretch two strings, one of them fixed, the other capable of being made tighter or looser. Cause them to vibrate, and stretch the second until it produces exactly the same tone as the first. Absolute accuracy may be secured by the use of two tuning forks, one of which is provided with weights on the prongs (see Fig. 7). As the weights are moved the tone is changed. The graduated scale will indicate the degree of accuracy attained.

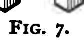


FIG. 7.

Some people are unable to distinguish between the pitch of one note and that of another. Such people are called tone deaf. This defect may result in the person's being unable to change the voice from a monotone. When the tone deaf person sings, he sings the same note, varying only the intensity of the sound. Sometimes people know two notes. One young woman of my acquaintance has two notes, one of which she uses for soprano, the other for alto, and she sings the two parts equally well. Another friend of mine, a young man, who has only two notes, uses them alternately when singing. The result is perfectly ludicrous. Both of these young people are utterly unconscious of their defect, and sing out loud and clear. It is pos-

Tone deafness.

sible to overcome this defect in the majority of cases, if the afflicted person is willing to take a course of training.

Fortunately, we are not all tone deaf, but we are all deaf to a certain extent. The degree of deafness may be roughly estimated by the "railroad experiment," so called because commonly used by railroad corporations to test the hearing powers of their employees. The subject of the experiment is seated in a room from which all disturbing elements have been carefully excluded, where as near as possible to perfect quiet may be secured. The eyes are closed, that no temptation to devote the attention to sight objects may be presented. One ear is carefully sealed with cotton. A watch is then held near the other ear and gradually removed until it can be no longer heard. This distance is measured. Then the watch is brought from a distance until the subject can just hear the tick. The average of these two distances is compared with the normal distance of about twelve feet, and the degree of deafness for one ear is found. The experiment is then repeated for the other ear. The source of error in this experiment is to be found in the fact that from no room, unless built for the purpose, can all distracting sounds be excluded.

All are deaf to a greater or less degree.

Test, railroad experiment.

Of what use are two ears? Do we hear twice as much as if we had only one? Close one ear tight and make some observations when you take your next walk. Can you tell from which direction a sound comes without knowing the location of its source? Can you tell how far away the source of a sound is with one ear? Sounds being produced by waves of air, how is it that we judge distance and direction by using both ears better than we could with only one?

Value of two ears.

Problems.

CHAPTER IV.

THE SENSES—SIGHT.

Of all the senses the sense of sight is most valued by a large majority of human beings. This is true for several reasons, among which may be mentioned the fact that to this sense we delegate many of the results acquired by the observations of the other senses, making it a kind of pack-horse for recognizing purposes. Again, the nature of sight is such that sensations may be gathered from the greatest diversity of objects, especially as regards position. With no other sense could we gain information about the fixed stars or planets, the moon or sun; while the whole world of color would be shut out from our comprehension but for this sense.

Reasons why sight is so valued.

Then, too, the sense of sight seems especially fitted to work in harmony with any and all of the other senses. In connection with the sense of touch, we connect the proper lights and shades with the touch quality roundness; when sight and taste work in harmony, we find our mouths "watering" at the sight of a body whose color suggests an apple, and so on.

Works in harmony with all other senses.

With the physiology of the eye as the organ of sight we have little to do. The mechanism of the eye will be found to resemble that of the ordinary photographic camera in many respects. There is the lens, with the diaphragms and focusing apparatus, the screen, or retina, upon which the image of the object is cast "bottom side up and wrong side to." It is a very delicate instrument, and one of which we should take the very best of care.

Mechanism of the eye.

And yet, in spite of the fact that we throw so much responsibility upon the sense of sight, the amount of original information gained by means of this sense is not so great as one would naturally suppose. Shades of color and differences in intensity of light are the only things that come to us through the eye unaided by the other senses. You may feel a little inclined to disbelieve this at first. If so, just count up all the things that you could possibly know if you were blind, and you may succeed in convincing yourself.

Original knowledge gained by sight.

Let us now find out, if possible, what it is to see. By means of vibrations of the ether, rays of light from all the points of an object to be seen strike the eye, pass through the lens, and are reflected upon the retina at the back of the eye in an inverted position. But this is not seeing. It is

What is it to see?

only the mind that can see. Is this picture on the retina carried to the brain? No. The retina is really only the enlarged end of the optic nerve. The arrangement of the nerve fibers will be easily seen from the accompanying diagram.

There is a retina in each eye, upon which is produced a distinct picture of any object looked at, and an optic nerve, which acts as a conductor from each eye to the

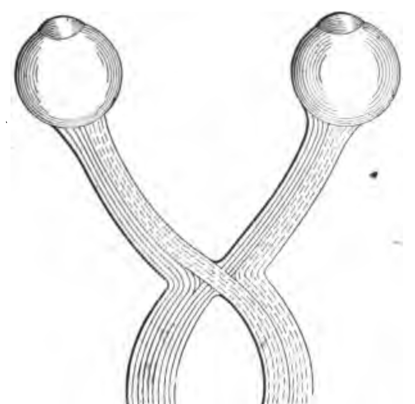


FIG. 8. Fibers of the optic nerve.

brain. These optic nerves meet at the base of the brain, and a part of the fibers of each cross and join themselves to the fibers of the other, thence proceeding to the occipital lobe of the brain on the other side from the starting point.

Arrangement of fibers from two eyes.

Can you suggest any possible reason for such an arrangement? The retina is so delicate

Problem.

as to be affected by the reflected rays of light. What kind of a nerve is it?

It cannot send the picture to the brain, but it does send an impression to the occipital lobe, where it is changed to a sensation. The mind seizes upon this sensation and interprets it into light or color, or, perhaps, making use of the associated impressions received through the other senses, the mind may interpret these light and color rays into the body from which they came.

Process.

Problem. What five things of importance have we thus learned concerning the eye and sight?

If we had but one eye, the image that would be formed would differ in some respects from that formed by two eyes. Many students maintain that we could see things in only two dimensions through one eye, which would cause everything to appear flat. Others maintain that knowledge of the third dimension, or depth, is original through sight, and that it comes to us through one eye only less accurately than through two eyes. It is certainly true that, whether as original or as the resultant of rearrangements and combinations of the data furnished by the senses of sight and touch, we find ourselves possessed of the power of interpreting into sensations of depth and distance the stimuli which act upon the

Seeing with one eye.

retina of one eye. One case which has come to my knowledge shows that even distance may be pretty accurately measured by sight when a person has been deprived of one eye since infancy.

If we had but one eye we should be partially blind. It would be possible that an object several feet high might be right before us at a short distance without our seeing it unless we turned the eye. That is to say, there is a certain spot in the retina that is not affected by light, a spot that is totally blind. This spot is where the optic nerve enters the eye.

Blind spot.



FIG. 9. Test for blind spot.

Suppose we try to locate the blind spot. Hold the book at arm's length and, carefully closing the left eye, look steadily at the character ⬭ in the figure. You will see the other characters also. Keeping the eye fixed upon the ⬭ draw the book slowly toward you. Presently the + disappears. As you continue to draw the book nearer, note what happens.

Test to locate blind spot.

Can you devise any means of mapping out the space covered by the blind spot of the right eye? Of what shape would this space be?

Problems.

To find the blind spot of the left eye look at

Other eye. the +, closing the right eye and repeating the experiment.

The effect of the blind spot upon our seeing with one eye would, doubtless, be largely neutralized by the

Unsteadiness of the eye. unsteadiness of the muscles. The eye is unable to gaze at any object steadily for any length of time. All the muscles seem to be in constant motion.

If you close one eye and concentrate your gaze upon the accompanying figure for a moment, what do you



FIG. 10.

notice about the edges of the black and white spots? What effect would this have upon the space covered

Problems. by the blind spot? Does this quivering of the muscles of the eye, with the consequent change of the point of regard, have anything to do with the visual measurement of the size of objects?

If you have ever looked through a camera, you have doubtless noticed that certain parts of the picture are far clearer than other parts; that near the edges the

picture grows hazy and indistinct. So with the eye, there is a certain object upon which we focus, though we see more than this single object. Fix your gaze upon this *word*. How much more can you read than the word itself? All that the eye takes in is called the *field of vision*.

Field of vision.

In order to map out your own field of vision, try the following experiment. Upon the blackboard make a dot. With the eye six inches from the board and gazing steadily at the dot, note the position in which you can just see the point of a pencil in the outer edge of the field of vision. How far can you see it? What use do school teachers often make of this fact?

Experiment.

We shall need a more accurate method of finding the extent of the field of vision before we can define its boundaries satisfactorily. Try the following. Fixing the gaze, one eye being closed of course (as in all these experiments), upon some object on a level with and directly in front of the eye, allow some person standing behind you to thrust a pencil forward until you can just see the point of it. Do this for four positions — outward, inward, upward, and downward. Note the angles made by lines from the eye to the object upon which the gaze is fixed and to the pencil point where first seen.

Method of finding limits of field of vision.

Can you see outward 85°, inward 75°, upward 70°, and downward 80°? If these are approximately the limits of the range of the field of vision, can you tell what effect the difference in the angles would have upon your judgment of distances in the different directions? Let us see. Draw a horizontal line upon the board. Now close one eye and keep the head upright. Draw without measurements a perpendicular line equal in length to the first, bisecting it and bisected by it. Now measure each section of both lines and note the results. Explain any discrepancies.

Limitations of vision as affecting judgment of distances.

Under ordinary circumstances we see, not with one eye, but with two, which makes a vast difference with us. Binocular vision is the vision of space, which we call seeing things in relief. Let us attempt to find out just what this seeing in relief means.

Binocular vision.

In the first place, is it possible that the nature of the pictures thrown upon the retinas of the two eyes is changed in any way by the use of two eyes instead of one? Certainly not. Then we must look elsewhere for our explanation.

Seeing in relief.

Hold a thin book or a card directly in front of the face, vertical and with the edge toward you, at the distance of about a foot. Look at it, first with one eye,

then with the other. Do you see any difference in the pictures presented? What we see with two eyes must, then, be a composite picture, made up of the two pictures seen with the two eyes.

Experiment.

This may be shown to be true by a great variety of experiments, of which I will suggest only samples. Measure the distance between the pupils of your eyes. Make two dots at this distance, say two and a quarter inches, apart upon a sheet of paper. Gaze steadily at and through the dots as though you were throwing them back of the paper into space. What do you see?

Experiment.

Again, hold two pencils perpendicularly on a line in front of the face, and four or five inches apart. Look first at the farther pencil. What do you see? Which of the images belongs to the right eye, which to the left? Find this by closing one eye, then the other. Look now at the nearer pencil, and repeat the experiment as before. In this way, what have you learned about binocular vision?

Problems.

The ordinary stereoscope serves very well to illustrate the principles of binocular vision. Why is it that with the stereoscope we see only one picture? If you have no stereoscope the following experiment will answer the purpose. Hold a card from the nose to the middle line in the figure.

Principle of the stereoscope.

As you look at the circle with one eye and the dot with the other, they will soon travel toward each other until the dot will rest in the center of the circle. By drawing or clipping pictures and experimenting, you can produce any combination you wish.

Problems. What effect would be produced by making two spots of different colors and looking at them in this way? What use can be made of this fact?

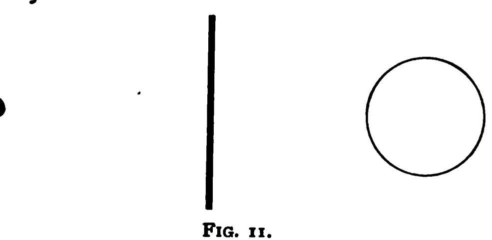


FIG. 11.

Binocular vision defined. Binocular vision, or seeing things in relief, is thus found to be the combining of two images with their lights and shadows in such a manner that the seeing mind receives impressions which it interprets into three dimensions.

We saw at the beginning that the original knowledge gained by sight is light and color. Some little examination of the phenomena of light and color may be of interest and value to us.

Threshold of light. We are, at the outset, confronted with the subject of the threshold of light. We know what darkness is, — the condition under which

the ether does not vibrate with a velocity sufficient to produce an effect upon the retina. But the cat can see in the dark far better than we. Why is that?

There must be some point where we shall just be sensible of the presence of light. Would the statement which has been made, that the threshold is reached when the light is "equal to one three-hundredth of the light of the full moon reflected from white paper," be accurate? Why? What bearing has the question concerning the cat upon this subject?

Problems.

A curious fact may be noted here. The sensation of light may be produced artificially. If a current of electricity be passed through the eye, a distinct sensation of light results. The same sensations of light may be obtained by pressing the finger upon the eye. It is a common experience with young people who are learning to skate that they fall upon the ice, sometimes striking the head with considerable force. They declare that they "see stars." Do they really see stars? Points of light may be seen by causing a sudden jar to the optic nerve.

Sensation of light may be produced artificially.

Next to the threshold of light comes the threshold of change in the intensity of light. This will be found to vary with different colored lights. Differences of one one-hundredth in a white

Threshold of change in intensity.

light may be detected by an ordinary observer, some persons being able to detect even smaller differences, while others cannot detect differences smaller than one seventy-fifth.

Why are we unable to see the stars in the daytime?

Problems. Why are we able to see the moon sometimes during a part of the day?

It is a matter of no small importance that the strength of the eyes should be ascertained, in order that they may not be strained and injured by school work. Many a pupil has been pronounced incapable of doing good work in school, or even of stubborn indifference to school work, inattention, and idleness, when the secret of the trouble was in the eyes, and the real fault lay, not in the pupil, but in the teacher, who failed to discover the defective vision. A physical examiner in one of our colleges recently said that a young man had just passed through his hands, one of whose eyes was incapable of seeing more than one-fourth of the normal distance, and yet the poor fellow had never found out that anything was the matter. He had been doing nearly all his work with one eye for more than twenty years without knowing it, and his teachers had never found it out.

Importance of ascertaining the condition of the eyes.

Any person may test the eyes with sufficient accu-

racy to know whether a specialist should be consulted at once. Secure from any optician a test card. Test each eye separately by covering the other, and you will easily be able to determine the amount of variation from the normal. You should find out whether the variation is due to near-sightedness (myopia) or far-sightedness (hypermetropia). For this purpose many schemes have been devised. The simplest, and therefore the best for the unprofessional examiner, is to ascertain the variation from the normal distance by moving the test card until it can be easily read. If moved toward the subject examined, you have a case of near-sightedness, if away from the subject, it is a case of far-sightedness. When the pupil's eyes show nearly the same power, near-sightedness may be nothing serious unless it be very marked. All cases of far-sightedness, however, are serious, and should be sent to a specialist for treatment at once.

Method of testing the eyes.

In case a test card cannot be secured conveniently, almost any one can make one that will do just as well by expending a little time. Letters the size of the following should be drawn, having the height five times the width of the component parts. Take a piece of cardboard and cut a hole large enough to show only one letter at a time. The

Home-made test card.

B H G F P

slip may easily be arranged to slide past the hole. These letters should be read at sixteen feet.

If the person being tested can see them at ten feet, would he be near or far sighted? If he could see them

Problems.

at thirty feet, what would you say to him? Give the equation in each case.

If vibrations of the air are the cause of light sensations, how does it happen that we see different colors?

Different colors due to different velocities of vibration.

The answer to this question is to be found in the changes in the rate of the vibrations. The main prismatic colors — red, orange, yellow, green, blue, and violet — are caused by vibrations varying, as physicists tell us, from about 460 billions in the red to about 730 billions in the violet rays.

Is it to be supposed that the prism exhibits all the rays from a sheet of sunlight, or, if not, what becomes

Problems.

of the rays beyond the red and violet? Must we conclude that the human eye does not transmit impressions from rays slower than red or faster than violet? Look across a hot stove. You see "heat waves," but no color. Why?

Between the red and the violet we have a constant increase in the number of vibrations, a sort of chro-

Chromatic scale.

matic scale corresponding to the musical scale, except for the fact that in the musical scale the

change is periodic, while here it is continuous. How many shades of color are there in the spectrum?

If the three prismatic colors — red, green, and violet — be combined, the result will be white light. These are the so-called primary colors. By a mixture of these colors in due proportions all other hues may be produced. The painter tells us that the fundamental colors are red, yellow, and blue; by which he means that he uses these three colored paints to produce the desired effects. Colors and colored pigments are different things and should be kept separate in the mind, as may be proved by mixing the fundamental colored paints — red, yellow, and blue — and comparing the resultant with pure white.

Primary colors and primary pigments.

Colors may be tested and compared by the method suggested in the *Standard Dictionary* under the word *spectrum*. Any spinning top will serve the purpose, provided it has a handle to hold the color disks when made according to the prescribed formula. When the top carrying the color disks is spun, the colors are combined in the proportions of the disks.

Method of testing and comparing colors.

We found, when studying the sense of hearing, that not all ears are affected by the same range of vibrations. The same is true of the eyes. Strange as it

may seem, some people cannot tell one color from another. Such people are called color-blind. About one person in every twenty-five is troubled in this way. Some of these afflicted mortals are worse off than others, however, as we shall see.

Color blindness.

Some are red blind, and to these everything that would appear red to the normal eye has the same appearance as green. They cannot tell the difference between a red and a green light. Two United States flags, one with red stripes, the other with green stripes, would look just alike. Moreover, every shade into the composition of which red enters would be affected.

Red blindness.

Green blind people furnish the complement to the red blind people. To them all colors into which green enters are changed, becoming mixed with red. A story is told of a young man who wanted to be an artist. So long as his colors were ready mixed and labeled, he managed very well; but one day he dropped his box of colors. After he had rearranged them he painted a picture in which the leaves and the grass appeared a bright red. The young man was obliged to seek a calling in which color played a less prominent part. Was he red blind or green blind?

Green blindness.

Other forms. A few people are violet blind, and a very few are totally color-blind. Think what a misfor-

tune it would be to see everything in plain black and white!

Color blindness is due to a defect in the eye, and, in many instances at least, is hereditary. It is a matter of no small importance that we should know whether we are color-blind or not. Sometimes life depends upon the ability to distinguish colors correctly. If we cannot tell the difference between red and green we should not apply for a position on the railroad, where "red means dangerous" and "green means safe," or on the sea, where the direction in which a vessel is going at night is indicated by the color of the light displayed. Persons applying for such positions are generally subjected to a severe test in assorting colors, but sometimes, after passing all the tests, are found to be color-blind.

Cause of color blindness.

The easiest and most effective way to make a test for color blindness is to secure three skeins of silk or worsted dyed in the standard colors — bright red, pale green, and violet. Then procure a variety of shades, and, beginning with the violet, shade off from the standard color. After the violet take the green, and lastly the red.

Test for color blindness.

All people are totally color-blind in the outer edge of the field of vision. We can see an object before we can tell that it has any

All color-blind at edge of field of vision.

color. As it advances into the field of vision we know that it is colored before we are able to name the color.

Mistakes of vision occur in other directions as well as in color. Every one knows how easily we are deceived

Illusions. about the direction of a stick thrust into the water. That phenomenon is easily explained by the laws of refraction, but look at the accompanying figure.

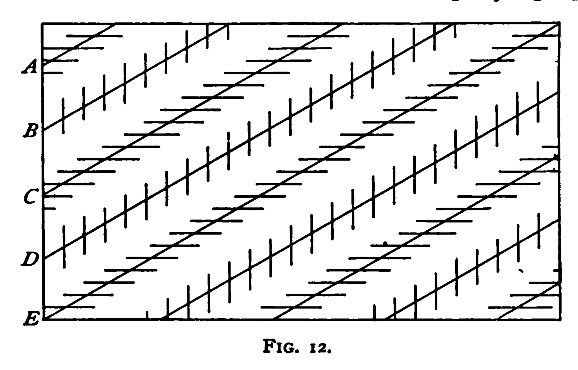


FIG. 12.

What relation do the long lines *A*, *B*, *C*, *D*, etc., bear to one another? Verify your opinion by meas-

Problems. urements. How do you account for the mistake? Do the angles which the cross-lines make with *A*, *B*, *C*, etc., have anything to do with it? Prove it by making several other figures. Again, in Fig. 13, what is the relation of *AB* to *CD*? Is the same true of Fig. 14? How do you account for the seeming divergence of the lines?

In Fig. 15, if the curved line *AB* were produced, where would it cut the line *CD*?

When considering the field of vision, we found that

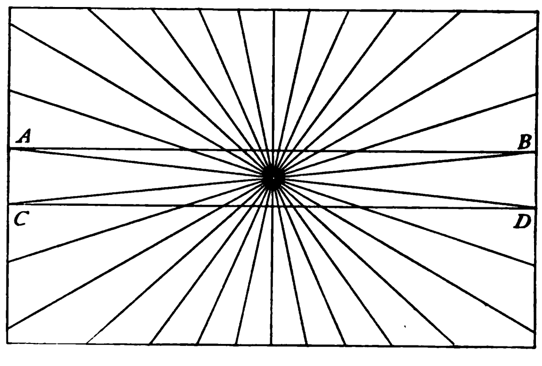


FIG. 13.

the eye could take in more in the horizontal than in the vertical direction. Now if this fact be considered with reference to the two eyes when used together, we

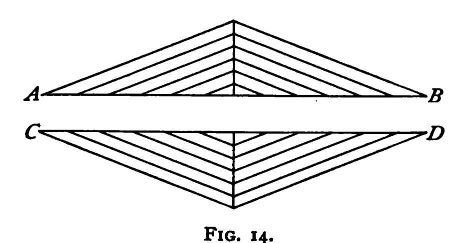


FIG. 14.

:all find ourselves able to see, without turning the :ad or the eyes, in a horizontal direction about 170°, ıile the vertical limit will be about 150°.

There will, then, be a natural tendency to distort and misjudge objects. Keeping the head in an upright posi-

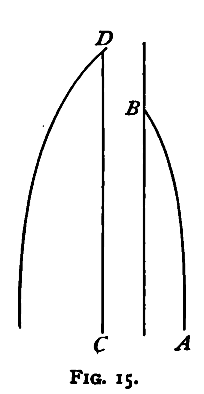


FIG. 15.

tion, draw (free hand) a square. Measure the length of the sides. Your square is really an oblong. What seems to be the shape of the two accompanying figures, and how do their dimensions compare with each other? Verify your opinion by measurements.

Natural tendency to distort objects.

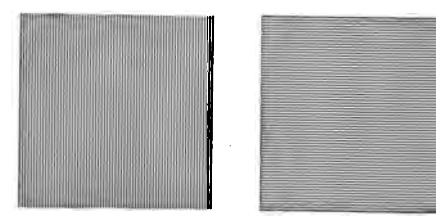


FIG. 16.

Another form of illusion is produced by the breaking of space. In Fig. 17, how does the distance *AB* compare with the distance *BC*? In Fig. 18, is *B* or *C* the continuation of *A*?

Illusions caused by breaking space.

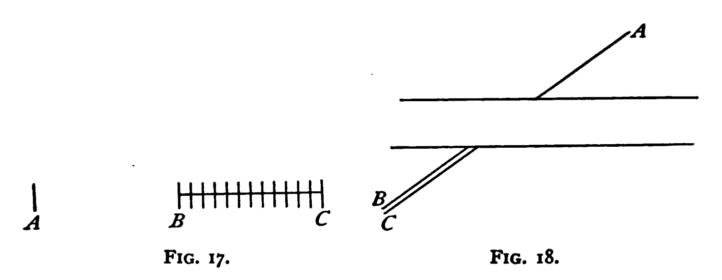


FIG. 17. FIG. 18.

Such illusions as are illustrated in Fig. 19, where all the horizontal lines are equal in length, may be characterized as compound illusions, because they are caused by the same illusions as those above, with the added element of failure of attention. In the last two sketches under Fig. 19, the attention wanders from the lines to the space included by the lines, and the judgment is formed accordingly.

Compound illusions.

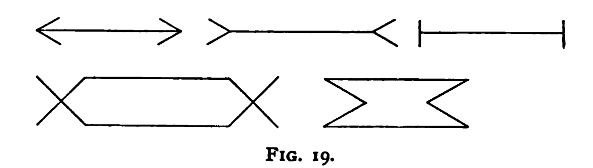


FIG. 19.

A person who knows just how the mind works will take advantage of these illusions to produce desired

effects. For example, dressmakers should know how to make a short person look taller and a tall person shorter. This may be done by producing the correct illusion. When we look at a person the eye takes in the whole space included by the outline of the dress. This produces the illusion of attention. Then, too, combinations of color make a great difference under the principle of illusion by breaking. A mountain seems to be near when seen across a level plain, while another just as near, seen across a rugged, hilly, wooded country, seems far more distant.

Effects produced by illusions.

What effect would the wearing of a vari-colored or striped gown have upon the apparent height of a person? Show how you would make a short, stout woman look taller, and a tall, slim woman shorter and stouter.

Problems.

As we realize how prone to error our sight may be, we should become more inclined to sympathize with the people who tell stories of seeing sea serpents, and with children, whose stories are too often set down as the productions of totally depraved imaginations. Such stories are probably, more often than not, the result of illusions no less honestly produced than those in the above illustrations. Children are especially liable to be

"Fish stories" often caused by illusions.

deceived, because they have not had enough experience of the world to counterbalance illusion with cool, calm judgment. "Fishy" stories nearly always come from ignorant people, those whose higher powers have never received much attention or cultivation; and, while it is unnecessary for us to be too credulous, we may give credit for honesty and truthfulness according to the light that a person possesses.

CHAPTER V.

THE SENSES — TOUCH.

Of the five senses, the sense of touch alone has no definitely located end-organ. Numberless nerves have their endings in the skin, all more or less sensitive to impressions and excitations. Touch sensations, therefore, may come from any part of the body.

Touch sensations from all parts of the body.

And yet, when we speak of touch, what particular portion of the body do we think of immediately? Why of that more than any other?

Problems.

What we call touch is probably nothing more or less than sensitiveness to pressure, reaching all the way from the highest degree of pressure that we are able to bear to the lightest contact. Indeed, the sense of touch is so highly developed in some people that they feel the pressure of an external body even before contact. This pressure is transferred to the mind, where it becomes a sensation, and is referred by the mind to an external cause. In this way our world of touch is constructed.

Touch and sensitiveness to pressure.

We shall include under the sense of touch not only contact, but also sensations of pressure, temperature, and the so-called muscular sensations.

Touch includes?

While it is true that nerves of touch may be found all over the body, it is also true that not all parts of the body are equally sensitive to contact. This may be shown by a simple experiment. Take a pair of compasses, and, setting the two points at any short distance apart, find out what parts of the body feel the two points as one. Touch the points only lightly to the skin. You will probably find that the distance between the two points, in order that they may be recognized as two, must be varied considerably. Note the distance between the points recognized as two, for the following places: (*a*) tip of the tongue; (*b*) tips of the fingers; (*c*) palm of the hand; (*d*) back of the hand; (*e*) forehead; (*f*) back of the neck; (*g*) between the shoulders.

Not all parts of the body equally sensitive.

This experiment should also bring out the fact that different persons have not the same degree of sensitiveness. A blind person, for example, will be found to be much more highly sensitive to touch than a person who can see. His eyes are of no use to him, and something has to take their place. All the other senses contribute their little share to make up for the lost sense.

Some persons more sensitive than others.

Touch and hearing especially become more alert. But is it because a blind person is endowed by nature with especially sensitive nerves of touch? Not at all. The blind person is obliged to use this sense, and by constant practice the sense is educated to a high degree.

Problems.

Would it be possible for every one to educate the sense of touch to the same degree of efficiency? Would it be a good thing for us to do so? Why?

Localization of sensations.

Again, when the nerve from any portion of the surface of the body carries an impression to the brain, the mind refers the impression to somewhere near the right place; that is, the mind localizes the sensation. I feel a pain. My mind has no difficulty in referring the pain to the proper place, whether in the hand, the foot, or any other member of the body. So with mere contact. Even with the eyes closed, the mind experiences no difficulty in distinguishing between the contact of the hand with any substance and contact of the foot with the same substance.

Phenomena resulting from localization.

The mind becomes so accustomed to interpreting sensations presented by certain nerves as coming from certain parts of the body that, if the particular member be removed, the mind goes on interpreting any affection of the nerve as coming

from the lost member. We often hear of people who, having lost a hand or a foot, complain of pain or cramps in the lost member. This is due to some irritation at the exposed end of the severed nerve, which formerly extended to the member. The nerve had been in the habit of reporting affections and impressions from that member, and the mind continues to interpret these impressions in the same manner as before.

And yet we cannot tell with absolute accuracy where we have been touched. You have, no doubt, had experience with that will-o'-the-wisp tickling sensation coming from some point on the surface of the body, which you were not able to locate the first time when you attempted to rub it.

Localization not accurate.

The following experiment will show you in a rough way about what is your liability to error in localizing touch sensations. Take a soft lead pencil, or a pine stick dipped in graphite, and, closing your eyes, press it gently against the skin. Remove it and try to touch the same place with the pencil point without opening the eyes. Measure the distance between the two places. This should be tried for several places — the cheek, the forehead, the back of the hand, the arm, etc.

Experiment.

Do you find that the variations are equal for all parts of the body? If not, how great is the difference?

Which parts of the body are more accurate, the trunk or the flexible parts?

Problems.

Suppose now that you extend the field of your investigations a little. Make the same experiments, but with several contacts at the same time. Do you find that the presence of several points of contact in unison has any effect upon the accuracy with which you can locate the points? If so, how much?

Problems.

In order to perform this experiment I would suggest that you take a thin pine stick, like the thin end of a shingle, and stick pins through it, dipping the ends of the pins in graphite in order that the points of contact may be easily located. This will show you how easy it is to puzzle the sense of touch. The ordinary illustration of this principle is the oft-repeated experiment of Aristotle. All boys have tried it many times. Having crossed the first and second fingers, place a marble between the ends of the fingers. A pencil will answer equally well. It is almost impossible to realize that there is only one marble or pencil there. Why?

Puzzling the sense of touch.

Again, touch accompanied by motion is more accurate than simple contact. Place your finger upon a polished desk, for example. There will seem to be no irregularities in the surface, but if you rub your hand across it you will prob-

Effect of motion on touch.

ably find that it is not perfectly smooth. A better instance still is that given in most text-books. Lay a hair on any smooth, polished surface, such as a piece of glass, a china plate, or a smooth desk. Cover the hair with several thicknesses of paper. By rubbing the finger over the paper can you detect the location of the hair?

Reaction-time.

We have thus noted some of the phenomena of touch, and have seen how the sensations in the brain are produced. It is necessary to note further that all this process takes time. When your finger is pricked, quite an appreciable amount of time elapses before the finger is moved away from the pin.

Experiment.

This reaction-time (Why is the term appropriate?), as it is called, can be measured very easily by another experiment. Let the class form a circle, each member allowing the fingers of the right hand to rest upon the back of the neck of the one standing next in line. Some one should hold the watch and start the circuit, keeping account of the time. Let the starter press upon the neck of the one next in line, and let the pressure be passed around as rapidly as possible. The time that it takes this impulse to pass through the class will furnish a reasonably accurate estimate of the reaction-time for the class. The total

time divided by the number in the class will, of course, give the reaction-time for one member.

What error would we be liable to make in finding the reaction-time for any one member by this method?

Problem. I have found by several experiments upon classes that it takes nearly ten seconds for an impulse to pass through a class of thirty students.

In making this experiment, it must be observed, we are liable to error, not only from the fact that the reaction-time varies for different people, but also from the number of processes involved. This reaction is more than the passage of an impression to the brain and thence to the finger-tips. There is the reception of the impression and the transmission to the brain, a physiological process; the reception of the impression and the interpretation into a sensation, a psychological process; the mysterious mutation into a motor impulse and the transference of this motor impulse to the fingers. There is also the time that elapses between the starting and stopping of the watch and the beginning and end of the experiment, respectively. A small matter, you say. Yes, but large enough to make us always just a little behind time. Scientists have learned the importance of taking this factor of reaction-time into account. Many differences in the results of scientific observa-

Reaction-time complex.

tions have, by determining the reaction-time of the observers, been cleared away.

Of course there is a reaction-time for the other senses as well as for touch. In order that we may understand the importance of accuracy and the method of securing it, we will describe one of the simplest machines employed and give some of the results obtained. In the first place, there is need of something that will make a record without loss of time. Such an agent is found in electricity. A record made by electricity will be as nearly accurate as anything can be. The only difficulty is in rendering the record made by an electric spark permanent. But where there is a will there is always a way. A large tuning fork, making just one hundred vibrations per second, is so arranged by connection with a battery that it can be kept in vibration. To one of the prongs of the fork is fastened a pointer, which also vibrates at the rate of one hundred times per second. Upon a cylinder is fastened a strip of paper smoked in a candle flame. When this cylinder is placed in contact with the pointer and revolved, the pointer will trace a wavy line upon the smoked surface, each complete wave representing one vibration or one one-hundredth of a second in time. If now, at any time, the connection

Method of finding reaction-time.

in the circuit is broken, an electric spark will be produced. This spark will cause a little explosion on the smoked surface of the paper, which will show as a dot. This will render the record permanent for study. By placing the person whose reaction-time we wish to find in connection with this instrument, his time for touch, hearing, and sight may be very accurately determined.

Practical value of knowing our reaction-time.

The practical value of such an apparatus may be illustrated by its application in the case of astronomical observers. It has always been noted that even the most skillful observers did not agree in the time at which planets crossed any given meridian. The trouble could hardly be with the planet, and how to overcome the difficulty was a problem. Five-hundredths of a second do not amount to much absolutely, but when carried through a long series of calculations, it is enough to destroy the accuracy of the result. By taking the observer's reaction-time, the disagreements and errors may be greatly reduced, if not altogether eliminated. In athletic contests of all kinds this element is of ,great importance.

Problem. Why do the crews on the river, the runners on the track, etc., etc., spend so much time in practicing "starts"?

Of still greater importance than reaction-time to us, as investigators of mental phenomena, is the threshold

of touch sensations. According to Weber's law, the threshold of change is one-third. That is, if you rest your hand on a table and place a three-pound weight upon it, and then, having closed your eyes, allow some one to add to the weight gradually, you will not be able to detect a change until one pound has been added. A more difficult and less explored field of investigation is the threshold of touch, distinct from the threshold of change. My own experiments have not proved very satisfactory, but there is one that every one can try.

Threshold of touch.

Go out into a swamp and cut sticks of alder of different sizes. Drive out the pith and draw a thread through each piece. Now lower the smallest piece gently until it rests upon the hand. You will probably not feel it at all. Keep on trying until you can just feel it. Weigh this smallest ball that can be felt. What threshold have you found? Is the threshold the same for the palm of the hand as for the arm or the forehead?

Experiment.

Closely connected with change in pressure is the effect produced by an intermittent pressure of very light intensity. Place the finger of one hand so that it will be just in contact with the other hand. Pass it along over the surface. You can hardly believe that it is not a fly walking over

Intermittent pressure.

the hand. The trembling of the finger produces an intermittent pressure or contact, and the result is a tickling sensation.

We shall find, too, if we try an experiment, that the temperature of bodies has an effect upon pressure.

Temperature and touch.

Lift a piece of very cold iron, another of the same temperature as the body, and a third just as hot as you can bear it. These bodies are really of the same weight, but you will not believe it until you see them weighed. The mind interprets sensations of pressure produced by hot and cold bodies as being more intense than those produced by bodies of equal weight at the normal temperature of the skin.

Problem. May this indicate that the mind is apt to mistake one kind of impression for another? Explain the phenomenon.

Temperature is, then, a subject closely connected with touch. Indeed, the connection is so close that we may call sensations of temperature a variety of touch sensations. Hot and cold are, to be sure, relative terms applied to bodies, the vibrations of the molecules of which are faster or slower than the vibrations of the molecules of our bodies.

Temperature areas on the skin.

We are more or less sensitive to these differences in vibration according to the portion of the surface of the skin exposed to contact with such

bodies. We find it necessary in winter to keep the hands and ears covered, because they are sensitive to cold and might be frozen. We need not cover the cheeks, because they are sensitive to warmth, and the blustering winds and frosty air only set them tingling; the blood rushes to them and they are in a glow. Thus we find that there are hot and cold spots in the skin. But these hot and cold spots are not found separated from one another, as we might fancy from the case of the ears and cheeks. You will find, if you perform the experiment indicated below, that the hot and cold spots are, as it were, interwoven, a map of the two appearing something like the accompanying figure.

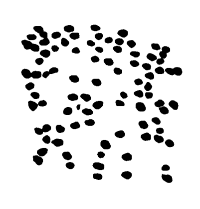


FIG. 20. Cold spots.

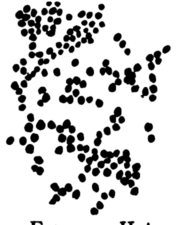


FIG. 21. Hot spots.

Hot and cold spot maps, and how to make them.

To make a map of the temperature sensitiveness of your own hand, you should first make an impression of the hand. Take a little plaster of Paris and, having formed a paste of it, lay your hand in it, pressing it down until you are sure that a full impression is made. Do not move the

hand until the plaster is set. You will then have a perfect map of the hand, with all the finer lines standing out clearly. Any point on the hand can be located on this chart accurately and at once. If, now, you heat a sharp lead pencil and pass it over the hand, you will be able to discover what points are sensitive to heat. Each hot spot should be marked on the chart at once. To find the cold spots, cool the lead on a piece of ice, or by thrusting it into ice-water, and repeat the experiment. If you use different-colored inks for marking, the same chart will do for both hot and cold spots.

Another test for temperature, one very much simpler than the one just given, is the so-called "water test."

Water test for temperature.

You have probably tried it many times, but not in this connection. Take three vessels of water, one just as hot as you can bear without scalding, another ice-water, while the third is of medium temperature. Thrust one hand into the hot, the other into the cold water. Upon removing them put both together into the third vessel. You may be surprised to find that water can be both cold and hot at the same time. We sometimes have the same experience when taking hold of some article, not being able for an instant to tell whether it is cold or hot. Can you tell why?

These experiments may also indicate that contact and temperature spots are sensitive only to their own particular kind of stimuli. A cold spot does not respond to heat or contact stimuli, nor a hot spot to anything but heat impressions.

Contact and temperature spots sensitive only to their own stimuli.

Find a cold spot on your hand. Can you prick it with a needle without feeling any appreciable amount of pain? Does the result of your experiment clear up any impressions that you may have had, or explain anything that you may have seen? Can a knowledge of these things be of any possible use to us; and, if so, what? How does the fact that there are spots sensitive to cold and others sensitive to heat bear upon the theory of physics that heat and cold are the same thing? Is it possible that certain spots on the skin may be sensitive to vibrations faster than a certain number and other spots sensitive to vibrations slower than that number, and how would this cause harmony between the modern scientists and the ancients who declared that heat and cold were two different things opposed to each other?

Problems.

Everybody knows that there is a normal temperature for the body. When the physician calls upon a patient he takes the temperature. If he finds it above $98\frac{2}{5}°$, he concludes that the patient

Normal temperature.

has fever, and treats him accordingly. But the normal point for temperature varies slightly for different parts of the body, and also at different times.

Problem.

Sometimes we find a room exceedingly hot at 70°, while at other times we find the same room cold at the same temperature. What is the reason?

Effect of brain work on temperature of body.

When we are working our brains we may find, if we try the experiment, that the temperature of the head rises. For this reason it is never well to study in a room of high temperature. About 66° or 67° is best for doing good headwork.

Problems.

You may remember how Dickens, in the *Tale of Two Cities*, makes Sidney Carton, when hard at work, keep a cloth wet in cold water on his head. Was that a whim of the author, or was it a sensible thing to do? What does the rise of the temperature of the head indicate?

Muscular sensations.

Another kind of sensation comes from the nerves in the muscles, and is called muscular sensation. This is a kind of tactile sensation, or sensation of pressure, differing from those already described in volume. When you attempt to lift a heavy body, there is a distinct straining of the muscles which is separated in the mind from the weight sensa-

tion, and which is absent when a light body is taken in the hand.

Still another variety of sensation comes from rotation. Children often whirl around until dizzy, and then turn the other way to "unwind." They sometimes carry the process so far as to produce nausea. We find the same principle illustrated in a game commonly played at young people's socials. The paper counterfeit of an animal is pinned in some conspicuous place. The young people are blindfolded in turn, and, after being turned about in both directions, attempt to pin the tail of the animal in the proper place.

Rotary sensations.

To investigate this sensation a little more carefully, place the subject of the experiment upon a piano stool or a study chair, blindfolding him. Whirl him around for about a full turn and stop him suddenly. Let him note the sensation produced. Then turn him rapidly, first in one direction, then in the other. He will soon lose all idea of the direction in which he is being turned.

Experiment.

The fact was mentioned that by whirling nausea might be produced. Many people feel the same effects when lying in a hammock, or when vertically rotated, even though the angle of rotation be small, as when sitting in a swing. We sometimes call the sen-

sation seasickness, and it is really the same thing. The cause is said by many of the best physiologists to

Seasickness. be the violent stimulation of the fluid in the semicircular canals of the ear by these rotary movements, just as when the boat rolls on the sea. The nerve leading to the brain is "set on edge." This nerve and the pneumogastric nerve terminate in closely adjacent centers in the brain. It is maintained that the stimulation of the nerve from the semicircular canals reacts upon the pneumogastric nerve, causing a general sensation of sickness. People who are deaf from an affection of the semicircular canals are never seasick. Physicians say that by administering small doses of bromide each day for about a week before the voyage begins, they can generally prevent seasickness.

CHAPTER VI.

SENSATION, PERCEPTION.

We have now made a study of the five senses, and have gathered some ideas of the materials which those scavengers pick up and bring in for the action of the mind. It is well that we remember that the senses throw open the gates upon the roads leading to the mind, and that any study of mind which neglects the senses is like the study of electricity without a battery. But, on the other hand, having the materials at hand, it is necessary for us to know how the mind gets hold of them, and what it does with them. This part of the subject must deal more exclusively with internal phenomena. Experiments will be more difficult, because human beings differ so profoundly in their ways of looking at things; and yet, notwithstanding all the difficulties, we may be able to gain some information, and to reach some amicable conclusions.

Office of the senses to gather material.

The immediate psychical effect of any action of any of the senses is called sensation. A pure sensation, however, should be simple, unaffected by

Sensation.

past experiences of any kind, a thing which has been impossible since the earliest hours of infancy. The above definition will answer all practical purposes if we understand that the sensation is complex.

The nature of these effects upon the mind determines the character of our knowledge of things, and so of our mental power. Our knowledge is broad and deep only as the sensations produced by the action of external phenomena through the senses are delicate and numerous. The person whose sense of sight is blind to the thousand things that present themselves to it every hour,

Sensations and knowledge.

> The man that hath no music in himself,
> Nor is not moved with concord of sweet sounds,

who has no appreciation of the perfume of the rose, and whose sense of touch finds no differences in objects sufficient to set it vibrating in ecstasy, can have but little knowledge of the great world without, and his world of thought, as we shall see, is also narrow and obscure.

Problem. As a foundation for all future knowledge, what would you recommend?

Just here it would be most profitable to study the principles enunciated by Froebel, the great originator of the Kindergarten. Note how he went to the very foundation of things, how he proposed to make use of

the senses of the children, to train and bring them under control, and so to build up the mental power. The "three R's" are all very well in their place, but more mental power is the great need, and it will never be attained until we go down deep into the first principles and train the feeders of the mind, — the five senses, — so that sensations, the raw materials upon which alone the mind can work, shall be sufficiently numerous and delicate to furnish the ever active mind with all it wants to use.

Value of the Kindergarten in cultivating mental power.

In order that any sensation at all may be produced, at least four things are necessary. First, there must be an external stimulus. Second, there must be a nerve capable of being affected by and transmitting this stimulus. Third, a receiving agent is necessary, which agent must have the power to receive the stimulus presented by the nerves. Fourth, the stimulus must be so transmitted and presented as to affect the receiving agent.

Four prerequisites to sensation.

These conditions of sensation will also show the limitations to which we are all subject. Comparatively few stimuli reach the agent in such a manner as to produce sensations. If we take, for example, the three senses affected by vibrations of the air, we shall gain some conception of the narrow limitations within which we are confined. Vibrations

Limitations of sensation.

of the air may vary in number from one to infinity per second. When the number of vibrations is fewer than eight per second, no sensation is produced. When the number ranges between the extremes of eight and sixty thousand per second, sensations are produced which the receiving agent interprets as sound sensations. Above sixty thousand, though the number of vibrations constantly increases, no effect is noticed until they reach about eighteen millions, when the nerves of touch transmit them, and the agent interprets them as heat sensations. Passing on from heat sensations there is another long blank until we reach some 462 billions per second, when the eye receives an impression which is interpreted as red light. As we pass through the colors of the spectrum the vibrations increase in number until we reach the violet at 733 billions, beyond which all is dark.

Problem.

Can you suggest why the colors at the red end of the spectrum are called the "warm colors," and those at the violet end the "cold colors"?

Intensity and quality of sensations.

Sensations differ from one another in intensity (or quantity) and in quality. The intensity of a sensation is varied by several factors. Within certain limits, the strength of the sensation will be proportionate to the intensity of the stimulus.

Why does a brass band attract children more strongly than a string band? If a strong stimulus is constant, what will be the effect upon the delicacy of the sense? When a parent or teacher habitually speaks to a child in loud tones of command, what is the effect upon the obedience of the child? Why?

Problems.

Again, we may materially alter the intensity of a sensation by turning the attention toward or away from it. If we have a slight headache and devote ourselves to thinking about it, we may make it much worse; or, by turning our thoughts into other channels, we may lessen the pain.

Effect of attention on sensations.

The intensity of a sensation at any given time will be affected by our bodily condition at that time. If we are in good health, painful sensations will be weakened, pleasurable sensations will be strengthened.

Effect of physical condition on sensations.

The intensity is also affected by the quality of the sensations, which, in turn, is changed by the degree of intensity.

Quality and intensity.

The quality of sensations is, however, mainly dependent upon three factors. First, the source and channel through which the sensation is produced, as, for example, when we test any object by the different senses, receiving sensations of five distinct qualities.

Quality depends on 1. Source.

Second, the quality is changed if the sensation is continued through a long time. A pleasurable sensation becomes painful when continued too long. Can you give examples?

2. Time continued.

Third, the quality of a present sensation is affected by the one immediately preceding, as is most easily proved by the sense of sight. Look steadily at a green color, then turn to a red color, and note the effect of the green sensation upon the new one.

3. Nature of preceding sensation.

Sensation, however, is not knowledge. It is only an indispensable prerequisite to knowledge. It is merely the arousing of the mind to activity. Up to this point the mind has been the passive recipient of the influences brought to bear upon it.

Sensation not knowledge.

The first real action of the mind is the complex action which psychologists call perception. Perception (*per* = through, and *capio* = take) is easily separated into two elements. First, a sensation presented to the mind is immediately referred by the mind back into the region whence it came. Second, the sensation is referred to some particular body as capable of producing it. For example, certain vibrations of ether strike my ear, producing a sensation of sound. My mind refers the sensation back into the outside world, across the street,

Perception and the elements that compose it.

and to the impact of hammers upon nails as the cause. A house is building there. As we shall learn later, all the elements of knowledge are contained in this one experience, but the same is true of any experiment that might be suggested.

The percept. The result of these two processes is to bring the object producing the sensation immediately before the mind. This presented object is called the percept.

Formation of percepts. If you try any number of experiments, you will find that it is impossible to receive a sensation without instantly referring it to some definite object in some definite locality, though occasionally this reference may be neither very clear nor very definite. But it must not, on this account, be supposed that the formation of a percept is natural from the very outset of our career. It is a growth. Children in infancy do not form clear percepts. Indeed, it is some time before they form percepts at all.

Problems. If you have an opportunity to experiment with an infant, you will find it profitable and interesting to discover at what age percepts of the different kinds of sensations are formed. Ask yourself such questions as the following, and carry on your observations until you reach a satisfactory answer. How early in life does the child turn the head in the direction of

a sound? At the first turning of the head does the child perform both of the operations noted above, or only that of localizing the sensation? How soon does the child follow with his eyes any bright object? How far in visual perception has he advanced? etc.

Why is it that, when perception is mentioned, we always refer the term to visual perception? And why is it that, if we wish to be absolutely certain of anything, we want it put in "tangible form"?

Problems.

As a matter of fact, the great mass of the elements of knowledge received by the mind comes through the two senses, touch and sight. The most numerous elements are tactual, such as size, shape, or form, distance, roughness, and smoothness, etc.; while the eye, originally giving us only color elements, has acquired the power of judging of size, form, distance, etc., by transference from the other senses.

Touch and sight percepts.

In illustration of the manner in which this transference of perception takes place is the true story of the boy, blind from birth, who had two pets, a cat and a dog. At last an operation was performed by which the boy received his sight. But he could not tell which of his pets was the cat and which the dog by sight, until, taking one of them in his hands, he felt it over, at the same time looking at it carefully. He was forming a new kind of percept,

Transference of perceptions.

and thereafter he had no difficulty in distinguishing his pets by sight alone.

Even we who are accustomed to make use of our eyes for everything are easily deceived, as we learned in the chapter on sight. The next foggy morning just look out of doors and see how much larger objects look than when the air is clear. Can you explain it?

Problem.

I said a moment ago that we always refer sensations to some particular object and to some definite place. You have probably wondered how we could do that if we did not know such an object and such a place beforehand, and how this new experience adds anything to our knowledge. Such questions as these have caused many psychologists to discard the term perception altogether, as signifying that which is impossible in the experience of grown people, and to adopt in its place the term "apperception," meaning by this term perception in relation to previous knowledge.

Apperception.

Using this term instead of perception, the answer to the suggested questions becomes at once apparent. The sound that I hear at the present time is compared with former percepts. If the same salient features are observed as in the other sounds previously heard, I at once give it a name. If

Application of the term.

there are differences, each point of difference constitutes an addition to the sum total of my knowledge, for knowledge is really discrimination, the detection of resemblances and differences, and we grow in wisdom as we become able to detect these resemblances and differences more rapidly and more accurately.

Knowledge biased by past experience.

We never see things as they really are. All our knowledge is biased by our past experiences to such an extent that a skillful observer could tell the nature of our past history by our casual remarks about any new experience.

Illustration.

You have probably heard of the man who stood behind a tree and overheard the remarks of the passers-by. The first man to pass remarked that the tree would cut into a large pile of lumber; another noticed that the bark was of the very best quality; a third mentioned the fact that its branches afforded a fine shelter for birds' and squirrels' nests; and a fourth spoke of its symmetry of outline and its grateful shade. Can you judge anything about these four people from their remarks? You see, no two of them formed the same percept of this one object. All perceived it in relation to the common, everyday experiences of their past lives — apperceived it.

Apperception cannot be avoided. We should, however, see to it that our experiences are broad enough,

so that when we perceive a new object the relations to former percepts may not be so limited as in the illustration just given. Above all, it is essential that our percepts be clear.

Need of forming clear percepts.

Do you think that you are in the habit of forming clear percepts? Write down the answers to the following questions, and then verify your answers. How many stairs are there between the first and second floors in your own home? How many windows are there in the church that you attend? What is the color of your friend's eyes? Draw a picture of the street through which you most often pass, locating the buildings on both sides. Such tests as these will be sufficiently accurate to show us our own habits in forming percepts.

Tests.

It is well worth the consideration of young people that the perceptive power must be developed during youth, if it is to be developed at all. Very few people possess the ability to become accurate observers after reaching the age of twenty-one. If we learn to perceive, we must do it at once. After the years of youth are passed we may be able to gain somewhat in clearness of perceptual detail, but not in power. The often told incident about the magician, Houdin, and his son, which has been duplicated in the experience of others, illustrates this point.

Perceptive power must be developed in youth if at all.

The magician has to depend upon the quickness and accuracy of his perceptions. Houdin, wishing to train his son, and himself also, spent a month in practice. As they walked rapidly along the street, they gave the show window of a store a single glance. Then they stopped to compare notes and to enumerate the things seen in that one glance. The father was the better observer at first, but before the end of the training, the son could far outstrip him, reaching a list of forty articles perceived at a glance so accurately as to be described. This is most excellent practice for any one.

Tendency to rely upon books instead of upon our own perceptive powers.

In these days we seem to be in danger of losing the power to perceive for ourselves. Before we visit a place we look over the guidebooks, or, worse yet, visit the place guidebook in hand, seeing only those things which the guidebook commands us to see; or, if not that, we see very little until we reach home and read about that which we ought to have noted on the spot. The publication of cheap editions of standard and other books, and the enormous production of books of all kinds have caused many people to give up perceiving except through the senses of favorite authors. When this is carried to excess, as is too often the case, and people attempt to read all the books that come in their way, reading-perception, if I may use the term,

poor as is that substitute for original perception of things, becomes dull and dwarfed, and a lassitude of the whole mental organism results.

Young people while in school have editions of standard works placed in their hands for study, so over-edited that there is no opportunity left for perceiving beauties of style or structure for themselves. They are driven into a semi-comatose perceptive condition by the editors, who are so anxious to show that they know all about the beauty of style, the depth and harmony of thought, that they can leave nothing to be investigated by the youthful reader. For this reason many percepts are formed third hand. Boys and girls gradually learn that they should prefer to know what some one says about an author, rather than to know the thought of the author himself. The result, so far as all formation of clear percepts through reading is concerned, is fatal. It is pedagogically unsound in principle, because disastrous to mental growth.

Over-edited books and their effect upon perception.

It may be well, in closing this chapter, to suggest some methods by which the perceptive power may be cultivated. Of course, cultivating perception is tantamount to cultivating the senses, with the added element of attention, for an analysis of which we may turn to the next chapter.

To cultivate perception is to cultivate the senses.

No method of training will secure results without persistent practice. The suggestion of one method will probably call to mind many others equally good.

Practice needed.

Sight perception may be trained by the Houdin method. Dickens gives us practically the same method in his description of Fagin and his treatment of the boys whom he was training to be thieves. All of us read more or less. Do you look at every word as you read? The eyes can take in a large portion of an ordinary page just as easily as one word, if trained by persistent practice. It is said of a late president of Yale that he could read a book while turning the leaves in a leisurely manner, allowing the eye to rest upon each page only for a few seconds. Try to take in several words, then a line, then two lines, and see if you do not improve.

Method of training sight perception.

One of the best things for the perceptive powers of young people is that they be in the habit of associating with those whose perception is very acute. There is nothing more effectual in arousing us to activity than the example of one in whom we have confidence. What a difference it makes in the pleasure derived from a walk or a ride whether your companions are on the alert for all

Associate with those whose powers have been trained.

beauties in scenery, for singing birds, for flowers and everything else that may be of interest, or careless and unresponsive to all such things!

Importance of choosing good companions.

Too much stress cannot be laid upon the choice of companions, for two people who are frequently together become more and more like each other. Gradually you and your friend will come to look at things from the same point of view. If he, or she, cares nothing for things that will develop perceptive power, you will find yourself losing much of your own zest, for it is much easier for the person on the higher level to be dragged down than for the one on the lower plane to be lifted up.

Accuracy before rapidity.

Before rapidity should be placed accuracy. The best method of securing accuracy is by careful analysis. Form the percept of the whole by forming percepts of the parts separately and in relation to the whole. Whether it be a landscape, or a house, or a face, seize upon the separate elements, and you will then have a clear percept of the whole.

CHAPTER VII.

ATTENTION.

WE have now selected the materials of knowledge and presented them to the conscious mind through sensation. The mind has grasped them through perception. We shall next trace the processes by which these materials are elaborated into thoughts, which constitute the highest product of the intellectual powers.

Summary.

The first thing to be done in the development of thought is to select the elements to be used. If the mind had no power to select, if all elements made impressions equally vivid, we should be in a state of constant chaos. For this reason the mind possesses the power of focusing itself, as it were, upon any element that it may select.

Selection of elements to be used.

This power we call *attention*. When we attempt to find an exact definition for attention we are met by difficulties. Like electricity, we may observe its action, discover the laws under which it acts, but it still remains an undefinable power of mental concen-

Attention.

tration. Moreover, the mind not only seems capable of concentrating itself, but it also may so control the senses as to make any one of them take the precedence of all the others, even to the point of excluding the others from the field of consciousness.

Attention differs from consciousness, which is the power of the mind to know its own acts and states, in that it is a directive power, its effects being traceable in consciousness itself. For example, we may be conscious of anger, but the power of attention may turn the action of the mind in another direction, and the consciousness of the presence of even that disagreeable emotion may vanish, displaced by another under the directive force of attention.

Consciousness and attention.

We shall need to examine this power, and to deduce the laws governing its action. There are two factors which determine the power of attention. The physical condition of the body is the first factor. No one whose nerves are weak or who is in poor health can give the attention that might reasonably be expected if the person were in sound health. Nearly two thousand years ago Juvenal said:

Factors determining the power of attention.

> Orandum est ut sit mens sana in corpore sano, —

It is a thing to be prayed for that there may be a sound mind in a sound body.

We may well echo these words in a slightly modified form. We should pray that every sound mind may have a sound body. Remember that any habit that weakens the nervous system or injures the health will detract just so much from mental power, and act accordingly.

1. Good health.

The second factor is to be found in the character of the stimulus to attention. A brass band will attract the attention from a street organ, and for two reasons. First, the volume of sound produced by the former is greater; and, second, the quality of the music is very much higher than that from the latter. It is not always true, however, that the stronger stimulus (in volume) arouses the attention. A "stage whisper" is sometimes far more effective than the loudest shouting.

2. Nature of the stimulus.

The objects toward which the attention may be directed may be physical, objects in the world of matter, to be apprehended by means of the senses; or, on the other hand, they may be ideas, objects within the mind itself, states of consciousness, thoughts, emotions. As I came across the park a few evenings ago, a company of the local militia was drilling. The sentries had just been called in, and the company had received the order to "Fall in!" Then came the following orders:

Objects of attention.

"At*ten*TION! Carry — ARMS! Forward — column *left* — MARCH!"

Now why were the orders given with that inflection? If the class will form in line and the teacher, or any one else, will give any series of orders without pause or change of inflection, you will soon discover the reason. Is it just as necessary to call the wandering thoughts of a company of men into line as their bodies? Before any number of men can act together their minds must be fixed upon the same object, in this case the commanding officer.

Problem.

Not only must the attention be attracted, but it must also be focused, centered upon one thing. When you are about to take a photograph, you focus the camera upon the object that you wish to be especially clear in the picture. Other objects in the picture will be visible, but the one thing focused upon will stand out more prominently than any other. So it is with the attention. We must be able to focus the attention where we will, making the single thing stand out clearly among all others.

Focusing attention.

Let us see how far you are capable of doing so. Select one word on this page. Fix your eyes and your mind upon that one word. Can you make the word seem to stand out separate from the rest, and to be formed of letters about one-fourth

Experiment in focusing attention.

of an inch high? If so, you know pretty well how to focus your attention.

While your attention was fixed upon the one word, the words about it were probably dimly seen at the same time. The attention may take in more than one object at a time. For example, the musician can play the piano and at the same time maintain a lively conversation with a friend. Habit has much to do with such cases, of course.

Attend to more than one thing at a time.

Problem. How many things can your attention grasp at once?

Again, there are two kinds of attention. First, involuntary attention, attracted in response to nerve action, very much like reflex action of the muscles. Indeed, involuntary attention is sometimes called reflex attention. Here the only question is, which object can present the strongest attraction? for the mind flits from one object to another, always following the greatest attraction.

Kinds of attention: 1. Involuntary.

The second kind is voluntary attention, which differs from the involuntary kind in that the will is present, and a sense of effort is distinctly felt.

2. Voluntary.

Give examples of each kind. Which kind do you think to be the more important? Which kind do animals exhibit? Which would you expect to find in

children? Which do you think is the stronger in your own case? Can you study effectively in a room where people are talking? Is it possible that some people never advance beyond the stage of involuntary attention? Give examples from your own experience and observations to prove the correctness of your answers to these questions.

Problems.

We may now consider the laws that govern attention. First, the attention is more or less likely to be attracted in proportion to the *intensity of the stimulus*. If the mind be directed toward one object, and a more attractive object come within the field of attention, the mind is very apt to leave the former and turn to the latter. Knowledge of this law may be applied in many useful ways.

Laws of attention: 1. Law of intensity of stimulus.

Why does the storekeeper display some of his prettiest goods in the front windows, building them up into artistic forms? Why, indeed, do we call the front windows of stores "show windows"? Why does the druggist place colored glass jars in his window, with a light just behind them? Is it true that the business man who can do these things most effectively is very apt to get the most trade?

Problems.

This law may also be applied in school life. The teacher who can present the strongest attraction to

the pupil's attention will secure the best results. No teacher is of any great value in the class room who cannot secure and hold the attention of the pupils.

Applications.

Stimuli may come from external sources, as in the cases just mentioned, or they may come from within. This is the reason why discipline may be lasting in its effects. The consequences of an action are viewed beforehand in thought, and the mind is stimulated to action by its own working.

Sources of stimuli.

Second, the attention is aroused by *curiosity*. All people are attracted by that which is new, or strange, or mysterious. I remember when the first car run by electricity passed through the streets of our city. A crowd of people followed it, doubtless with the expectation of seeing it come to a stop at the first heavy grade. They were curious. The thing was new in our streets. Men whom one would expect never to be drawn from their business by anything, dropped their ledgers and ran to the door to gaze on the new car. They had ridden on electric cars hundreds of times in other cities, but this was a new thing.

2. Law of curiosity.

Mention other examples where newness is the power that attracts the attention. Can you give any reason why merchants select new patterns for

Problems.

goods every season? Why does the milliner trim hats this fall in a different style from that worn last year?

The strange and mysterious have a peculiarly fascinating power. A sleight-of-hand performer or a hypnotic experimenter comes to town. A crowd of people can always be collected to see the performance, because of the strangeness and mystery surrounding it. Scientifically, the phenomena may be capable of easy explanation, and yet, if we are incapable of producing the same kind of phenomena, our curiosity impels us to go to see some one else produce them. A large portion of the power wielded by the so-called "Christian Scientists" and "Faith Healers" lies in their appeal to the attention of people through curiosity.

Strange and mysterious stimulate curiosity.

The third law may be stated thus: Things are apt to attract attention in proportion to their *size*. Especially is this true if the size be unusual. An elephant attracts attention more strongly than a horse; a giant draws a crowd of spectators if he appears on the street.

3. Law of size.

This law is applied by business men in a variety of ways. Not long ago a hotel was erected in a certain city. The owner, instead of building it of the same size as other buildings, made it several stories higher than any other building in

Application illustrated.

town. The result was that the hotel could be seen from all the country round. All visitors to town must see the hotel as one of the "sights." In this way the proprietor gets an immense amount of free advertising.

Do you think of any similar cases? How does this law apply in advertising through the papers? May it be possible that a point will be reached beyond which an increase in the size of the advertisement will fail to secure a proportionate increase of attention, and, therefore, of returns for the investment? Where is that point, and how may it be found?

Problems.

A fourth law is the law of *adaptation.* We direct our attention easily to those things that adapt themselves readily to our ordinary habits of life. A student of literature finds his attention wandering from a conversation about business, if a group of people near him are talking over the latest book; a scientist can with great difficulty force himself to talk fashionable gossip when others are enthusiastically discussing some new departure in scientific methods within his hearing; a farmer finds his attention attracted by crop conditions and the state of the market in cereals, and so on.

4. Law of adaptation.

Most pupils in school find it far easier to study one lesson than another. Why? You will doubtless

answer, Because they are more interested in one than in another. Yes; but what is interest? Is it not the result of fixing the attention upon any subject? When the attention is aroused and fixed upon any subject, that subject becomes interesting. Those of us who find any subject of study uninteresting have never had our attention sufficiently attracted to that subject to arouse our interest. The problem that we and our teachers have to solve is, How may the attention be aroused? If our lack of interest were due to the subject itself, no one would ever study it. We should never complain that any study is uninteresting. If we have any complaint to make, it should be directed toward the cause of this lack of interest, which cause generally lies pretty near home.

Interest and attention.

I shall call the fifth law the law of *motive*. The attention is apt to be attracted by objects that will serve a useful purpose with us. A certain boy in school can never be induced to learn his lessons in arithmetic. The world of number seems to be a sealed book to him. Presently he leaves school and goes into business. Suddenly he finds himself attracted toward figures, because by a skillful use of them he can get along faster, can do more business, can be of greater use to

5. Law of motive.

Illustration.

his employer. He soon becomes an adept in the arithmetical processes which he formerly disliked so much.

Problems. What is the reason for giving prizes in school? Do you think the plan a good one, or do the disadvantages outweigh the advantages? Do you consider a prize a sufficiently high motive for doing your best in anything? Does the "marking system" come under the same category as the prize?

6. Law of change. Still a sixth law is the law of *change*. We find it practically impossible to keep the attention fixed upon any single subject for a great length of time. It is far easier to learn a lesson in geometry, for example, if we study it until it becomes difficult to keep the mind at work, then turn to something else for a time, and at last come back to the geometry. The change seems to rest the attention.

The unexpected draws the attention irresistibly. The unexpected draws the attention with almost irresistible force. Upon picking up a paper the other day, my attention was attracted by a picture. A man, grip in hand and coat-tails flying in the breeze, was running to catch a train, followed by the enthusiastic plaudits of the crowd of on-lookers. All the accessories that could help to make the thing ridiculous were present. But why should this picture be placed in the advertising

column? Surely some one had made a mistake! All was explained when I read this legend below: "We are off for a little trip to the country, but we 'll be back early Monday morning to sell you," etc., and I concluded that some one had learned how to make a skillful use of this law of attention.

Laws connected with these.

Other laws might be suggested, but most of them would be found to connect themselves more or less closely with one or more of those already mentioned.

Voluntary attention.

Voluntary attention of the highest order consists in concentration, and produces many and varied phenomena. Many of you have, no doubt, seen plaster masks of great men. Though they are intaglios, you find no difficulty in making them seem to stand out in relief. In the following figure you will be able to look at the large end and so at the inner surface, or at the small end, and so at the outer surface, by directing the attention to the one or the other.

Problems.

A person who has a violent toothache sits down with an absorbingly interesting book. Presently the toothache is forgotten. Why? We take up our book and soon we cease to hear what people are talking about; in fact, we become totally oblivious of their presence. What do you judge to be the cause?

If the book is not interesting, we find it more difficult to become absorbed in it. The will has the power to turn the attention in any direction, but not to keep it fixed. Unless the successive points in a subject present a constant series of attractions, the attention soon strays off to something else, and the will must keep on turning it back to the subject in hand. This may serve to show

Office of the will in attention.

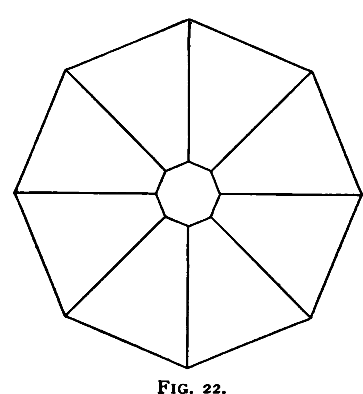


FIG. 22.

the relation between voluntary and involuntary attention, and to explain why it is so much more fatiguing to study a subject in which we are not interested than one which presents a constant stimulus to the attention. Added to the mental effort of the study itself is the effort of the will to keep the mind centered upon its work. For this reason it is said, very appropriately, that, "A person's power of attention may be con-

veniently measured by the degree of persistence attained."

Right here it may be well to notice the relation between attention and habit. This relation is reciprocal. Habits once formed exert a powerful influence. If we have formed habits of allowing our minds to run from one thing to another without direction, we must not be surprised if it is well-nigh impossible to hold them to any one subject for an appreciable length of time. On the other hand, all valuable habits are formed by the exercise of voluntary attention. When the habit is once formed the attention sinks into the background, or is applied to something else.

Attention and habit.

Give examples from your own experience or observation to illustrate the influence of habits upon attention, and of attention upon the formation of habits. Why do we wonder at the skill of the expert bicycle rider or club swinger? How was the skill attained? Does the expert need to keep in mind the movement that is to come next? Is the following statement true? All skill is due to habits that have been formed by the frequent recurrence of the same idea.

Problems.

Now, if it is true that our ideas tend to form habits, it must follow that the ideas that hold possession of our minds most frequently will determine the general

direction that our lives must take. If noble thoughts are our constant companions, the habits formed by them will correspond to the thoughts; but if our attention is turned to ignoble things, the habits developed will surely be of the same character, and in either case our lives will show to what our minds have been directed. The only way to get rid of bad habits once formed is to displace them by good habits; and the only way to form good habits is by turning the attention persistently toward the things that we wish to acquire.

Effect of habit upon life.

It is the function of education to direct the attention into the right channels, and through it to develop correct habits, both of thought and of action. It is a well-authenticated fact that continued attention to one idea excludes all other ideas. People of one idea are far too numerous. Such people have neglected to train their powers of attention in other directions, and have become narrow in consequence. The school curriculum should aim to cultivate power as well as to give information.

Education and attention.

Problems. Can you think of any classes of people who are especially liable to become persons of one idea? What should they do to avoid it?

The attention becomes fatigued rapidly by intense application to one subject. This fact is taken advan-

tage of by the numerous "professors" of hypnotism. The first principle of hypnotism is fatigue of attention, which finally puts the subject into a condition closely resembling somnambulism. While in this state the subject is especially sensitive to suggestions from the person who secured the attention at the beginning. If you ever attended an hypnotic exhibition, you have probably noticed that the experimenter never selects his subjects and begins his experiments immediately. He always makes it his first care to secure the undivided attention of his audience. Before going to the exhibition the attention of the people has been exercising itself in anticipation, and the strongest minds become easy victims to this fatigue.

Fatigue of attention.

Hypnotism.

I remember one of these exhibitions, when it was announced that volunteers from the audience would be taken as hypnotic subjects. Before the evening arrived there were several lively discussions upon the nature of hypnotism and the power possessed by the hypnotizer. One man in particular was loud in his denunciation of the whole thing as a fraud, and in his declarations that no man could hypnotize him. When the eventful evening came he went to the hall with the intention of discovering and exposing the fraud. So absorbed did he become that he became

Illustration.

the first victim, and when volunteers were called for he found himself on the platform before he knew what he was about. There, much to the amusement of his friends, he became as wax in the hands of an artist, and was made to perform in a manner strongly contrasting with his usual dignity.

Conclusion. It will be seen from this chapter that attention occupies an important place in our lives, determining largely the direction of our thoughts, and so of our hopes, aspirations, characters, and destinies.

CHAPTER VIII.

MEMORY.

THE elements of knowledge, collected by the senses, presented to and seized upon by the attentive mind, would still be practically valueless were there no possibility of retaining, modifying, molding, and recombining them and reproducing them at will. The presentative faculties, while of great value as an adjunct, would be of little use unless supplemented by the re-presentative faculties, — memory, imagination, and thought, — in which last we reach the acme of intellectual activity.

Presentation to be supplemented by re-presentation.

There seems to be a tendency among psychologists of the new school to consider memory, imagination, and thought as one and the same thing. It might easily be shown, however, that, though modes of action of the same re-presentative power, they differ in that they represent different and progressive steps in the process, from simple reproduction of clearly formed percepts up to a finished product which, while containing the reproduction elements, may be, as a whole, absolutely new.

Tendency of modern psychologists.

We shall consider the three as distinct, in order to bring out more clearly the progressive character of this most important division of psychology.

Memory may be defined as the power of reproducing any past experience in the form of an image which bears some resemblance, more or less accurate, to the object recalled.

Memory defined.

For example, select some object with which you are familiar, and write a description or make a drawing of it. Now compare your description or drawing with the original. Let some one hold an object before you for a few seconds, and then draw or describe it from memory.

Experiment.

Can you remember anything that you have never experienced or perceived? Can you remember and reproduce with perfect accuracy? Do you find anything in your reproduction that is not to be found in the original? If so, how do you account for its presence?

Problems.

It will be well for us to consider briefly the development of some of the powers involved in memory, and some of the laws of its action.

The first power to be developed in connection with memory we may call the power of assimilation. When a young child sees a man coming down the street, he immediately calls out, "Papa!" Why?

Memory powers.

When riding through the country the child calls nearly all animals by one of two or three names, — horse, cow, dog. Can you tell why? When a fresh sensation is presented to the mind, it seems to be referred by the mind (if I may so speak without being misunderstood) to that corner in which previous sensations like it in character have already found lodgment. Here it becomes an integral part of the sum total of this particular department of our knowledge materials. The points of likeness to past experiences are the attractive bonds of union. One day, as I was passing a store, I noticed a basket of green squashes. A little girl, whose mother was looking at other vegetables, happened to be standing by. I called her attention to the basket and asked her what those objects were. She looked at them critically for some time, and then answered, "Pears."

Assimilation.

Explain what was passing in her mind before she answered.

Problem.

Closely allied to assimilation, and next in order of development, is the power of discrimination, or the power which selects materials by differences. Early in life we learn to detect the difference between sensation of color, touch, and sound, and the differences once established we always discriminate with ease.

Discrimination.

When the child referred to in a preceding paragraph says "man" instead of "papa" for every one except his father, what new power is he acquiring? How far did the discriminating power enter into the case of the little girl who called squashes "pears"?

Problems.

Association is the third power involved in memory. This is the power that binds together into one compact whole all the elements of an experience, so that the recall of any of the elements will tend to recall the experience.

Association.

Fourth is reproduction, which is the power to bring again before the mind as an image that which was formerly before it in a presentative form.

Reproduction.

All these powers combined would not make a complete act of memory without the added power of recognition. We must know that the image represents a former experience.

Recognition.

Through all these powers, conditioning their action, runs the power of retention, of holding or keeping in the mind past experiences for future use.

Retention as condition of all.

From the use of the word "image," it will be readily understood that the objects of memory are psychical objects, as distinguished from physical objects. If the image is just as clear and vivid as the original percept,

the two differ only in the process of formation. In forming the percept, the sense organ was active; in forming the image, the senses remained passive, the internal machinery of the mind only being active. The nerve action in the brain itself was practically the same for the formation of the percept and the image. Very rarely, however, is the image an exact reproduction of the percept. It differs from the percept in distinctness of outline, in details, the minor points of the percept being modified or entirely obliterated in the image, and sometimes in even the most important qualities.

The image and the percept.

Why is a story so greatly changed after several repetitions?

Problem.

The difference between image and percept is well illustrated by the game called "Scandal." All sit in a ring, and some one starts the game by whispering a sentence to his neighbor, who passes it on just as he remembers hearing it. When the sentence has passed round the circle, the resemblance to the original sentence is apt to be very slight.

Illustration.

We may be interested in the question, How are images formed in the mind? No matter how clear the process, and how well-defined the causes, there will always be more or less of the mysterious about it all. You may demonstrate to

Formation of images.

yourself the method by looking at an object for some time and then closing the eyes. You still continue to see the object, though it is really shut out from view. This after-percept will indicate the method of forming an image. The retentive and reproductive powers are at work, and the memory image is already in process of formation.

Images in perception.

Indeed, in all our perceptions of things the images of former perceptions are present to react upon and modify the present percepts. This is the reason why two people, both perfectly trustworthy, often give strangely different accounts of the same event. What they have perceived before is present in the mind as an image which combines with the present percept, modifying it according to their individual idiosyncrasies.

What do we remember?

The question now arises, What do we remember? We are very apt to think that memory is an erratic power at best, subject to no law and under no control. As a matter of fact, however, every image formed in the mind depends upon some past experience. More than this even is true, for the character of the image present in my mind at this moment depends upon that which was present a moment ago. I was walking down the street in Chicago one stormy afternoon, when a young man

passed who very closely resembled a friend of mine whom I had not seen for years. Instantly my mind turned to the place where I had last met that friend, and soon was occupied with people and circumstances far away. When I attempted to trace the route by which my mind had arrived at its ultimate destination, it was by no means an easy task. You have probably had many experiences of a similar character.

All these instances of untraceable connections lead us to think that memories throng through the mind in a kind of haphazard panorama. And yet it is certain that an object perceived calls up the image of a former percept; this image suggests still other images, all in regular order, and connected by bonds delicate and flexible but strong and enduring. The laws which govern this connection between successive images are called the Laws of Association.

Connection between successive images.

Very few isolated impressions are made upon the mind. I look out of the window and see a carriage passing in the street below. The impression received is not simply an impression of the carriage, but I am also more or less clearly conscious of the street, the houses, and the general surroundings, though the passing carriage occupies the prominent place in the picture. If, now, at any future

Few isolated impressions.

time the image of this passing carriage should be recalled, the whole picture of the street and the surroundings would arise in the mind.

Law of contiguity.

This may serve to illustrate the first law of association, which is: Things contiguous in time or place tend to recall one another.

Application of law of contiguity.

But this law has also a wider application than would appear from the above example. The contiguity in time or place need not exist except in the association formed by the mind. The mention of Solon, the great lawgiver and statesman of Athens, may bring to our minds the image of Moses, or of Germany's "Iron Chancellor," if we have been in the habit of thinking of one in connection with either of the others.

Problems.

Tell what you associate with the following, and explain the reason for it: Washington, Christmas, Boston, Fourth of July, Puritan. Can you explain why it is so much easier to say the alphabet forwards than backwards? Suppose you see a person in bad company; what is the tendency of your mind? Does this fact have any bearing on the proverbial expression, "Avoid all appearance of evil"? and if so, what?

Another contiguous relation is that of cause and effect. When you see a man reeling down the street,

what images are called up in your mind? Give other illustrations of images called to mind through this relation.

Cause and effect.

Still another contiguous relation is that of similarity or contrast. In order that this relation may be operative in recall, the two images, or the percept and the image to be compared, must be before the mind at the same time. For example, you could not say that a wolf is not a dog unless you had the two images before you for comparison.

Similarity and contrast.

It has been hinted already that habit has much to do with association. It cannot be insisted upon too strongly that habitual association of things or images makes it certain that when one thing or image is present the image of the thing associated with it will soon appear. We shall see later of how great importance in the cultivation of memory is this fundamental law of association. If you wish to experiment with the working of this law, go out into the country on your bicycle. Do you find it easier or more difficult to ride in the beaten path than at the side of the road where no wheels have been before? In the same way, ideas and images seem to wear paths in the brain when habitually associated, and it is easier for the mind to work as it has done before than to mark out new paths at each effort.

Habit and association.

Besides the great law of contiguity there are several secondary and derivative laws that should be mentioned. These secondary laws are so called because they determine what particular image shall come to the mind, in distinction from the primary law which determines that a contiguous image will appear.

Secondary laws of association, their office.

The accompanying figure will illustrate the harmonious working of the primary and secondary laws. The

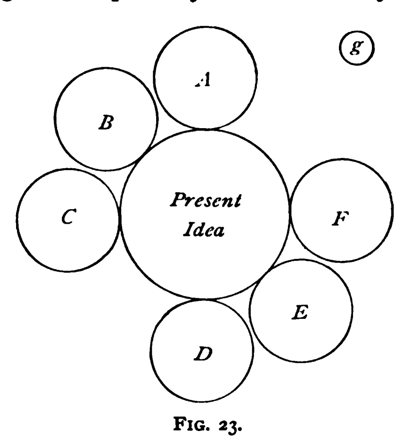


FIG. 23.

central circle represents the idea present in the mind now. Associated with it in past experience are several images, represented by the smaller contiguous circles. All of these images may be thought of as striving to gain the central position. The primary law of contiguity determines that one of these

Illustration.

contiguous images will follow the present idea instead of some other image, *g*, which is not in contiguous relations with the present idea. The question is, Which of these striving contiguous images will gain the ascendency and displace the present idea? This will be determined by the secondary laws.

Secondary laws: 1. Repetition.

The first and most obvious of the secondary laws is the law of *repetition*. Things often repeated are more easily recalled, and will tend to come before the mind more readily than things that are thought of only occasionally. Thus, in the figure, if the idea represented by *D* has been repeated oftener than any of the other contiguous ideas, *D* will probably replace the present idea. The poems that we used to read over and over in our early school days are much more easily recalled by suggesting contiguous ideas than many more beautiful poems that we have read since.

2. Vividness of impression.

Again, I remember, when a child, standing in the doorway while a thunderstorm was in progress. In an open field across the road stood an old hickory tree. Suddenly a bolt of lightning struck the tree and ran down into the ground at its foot, leaving a seam in the bark on one side of the tree. During a severe thunderstorm that experience always comes to my mind. *Vividness of impression* assures ease of recall.

A third law takes account of the *emotional condition* at the time of suggestion. When a person is in a buoyant, cheerful frame of mind, a thought or percept will cause a far different image to succeed from that which would be suggested during a severe attack of the "blues."

3. Emotional condition.

The *voluntary attention* has much to do also with the train of thought suggested by any event. We find ourselves able to control in large measure the direction in which memory shall act.

4. Voluntary attention.

A fifth law is the law of *recency*, but it is subject to so many exceptions that it should be stated only with the limiting clause, "other things being equal." With this provision, a recent experience is more apt to be recalled than one more remote.

5. Recency.

One other law of the greatest practical value is the law of *thought relation*. Things which you have made your own by tying them to other ideas by means of relation cords will tend to be easily recalled.

6. Thought relation.

Now give examples to illustrate each of these secondary laws of association.

It is not difficult to realize that thoughts and images follow one another in orderly succession under the operation of law during our waking hours. But there are several hours out of the twenty-four during which

we are asleep, and, we ask, what becomes of the laws of association then? Here, also, we shall find the laws operative, but the voluntary attention being in abeyance, and consciousness being in a more or less passive state, there seems to be no order or connection to the dreams that pass through our minds. For the phenomena of dreams I shall refer you to the larger text-books, only observing here that the mind is constantly active so long as we live, and that its actions are always subject to law. The fact that we cannot remember our dreams is no proof that we have had none. Who can sit down at night and recall every train of thought that has occupied his mind during the day?

Operation of laws of association during sleep.

The power of the association of ideas is far greater than we can believe without investigation. Find answers to the following questions, and give your reasons for them. A short time ago large sleeves were fashionable among the ladies. What caused the change to the present fashion? Suppose the present style had been first adopted by some one low down in the social scale, do you think it would have become prevalent? In the theaters of to-day we find it becoming fashionable for women to remove their hats. How do you suppose it to have been brought about? Why do careful business

Problems in association.

men inquire into the habits and company of their prospective employees? Would you object to being called an anarchist or a socialist? How is it possible that the publication in the newspapers of the details of horrible crimes increases the number of crimes of similar character?

Let us now ask what are the general conditions of retention and reproduction. Why does the mind retain and reproduce impressions made upon it? The first answer that suggests itself is: Because the impression is made so deep that it cannot be obliterated. The depth of the impression depends upon (*a*) the intensity of the sensation that produced it, (*b*) the focusing of the attention upon that particular sensation, and (*c*) the repetition of the sensation in the form of an image.

General conditions of memory.

Depth of impression.

For example, a far deeper impression is produced upon the mind by the sensation resulting from a sudden blow than by that resulting from a gradual pressure, and will consequently be much longer retained. Show how (*a*), (*b*), and (*c*) are illustrated by this example. As I was walking down town the other day I saw a steeple climber ascending a lofty church spire to gild the cross at the summit. So absorbed did I become in looking at him

Illustrations and problems.

as he hung suspended in mid-air that I found myself, in common with many others, standing in the middle of the walk gazing up at the man, who seemed but a pigmy.. It will be long before I forget about it. Why? If you wish to learn a lesson so that you will not forget it, which do you think the better plan, to read it over several times, or to read it over once and then repeat the substance of it to yourself several times?

It will be evident that retention is conditioned by sense impressions, because they are the raw material from which all mental phenomena are constructed. We may say, then, that we have as many kinds of memory as we have kinds of sensations. The power of retention seems to be a fixed quantity in the case of each individual, education making but little difference with it. All men are certainly not born equal in this respect, nor can they be educated into equality. More than this, the retentive power varies in the same person with the kind of sense impression. Some remember best what they hear, others what they see, etc.

Kinds of memory.

How is this in your own case? Which kind of memory is most strongly developed in you? Experiments may be tried to test the various sense memories. To test the muscular sense lift some weight, and after the lapse of

Problems and experiments, muscular memory.

five or ten seconds select from a number of weights one of exactly the same weight as the first. Note the difference between the two by actual weight. What per cent have you forgotten in ten seconds?

Hearing memory.

To test the hearing memory, use some stringed instrument with which you are not familiar, in the same way as the weights, sounding a note, and after five or ten seconds attempting to sound the same note; or sound a note with the voice in unison with a note on the piano. After five or ten seconds give the same note without the piano, if you can.

Sight may be tested by lights of different intensity; and so on, for the other senses.

Inaccuracy of memory.

All these tests will be somewhat inaccurate without measuring apparatus, of course, but will tend to establish the fact that in very few cases do we remember accurately for even five seconds. To carry out the tests with accuracy would be to establish a law for the progress of weakening of sense impressions.

An experiment often tried in my classes to establish the relative power of sight and hearing memory in a rough way is as follows: Make two lists of letters, eight or ten in number. Read one list aloud, allowing an interval of about a second between the reading of

two successive letters. When the list has been completed, let the class write down as many as they can remember. The second list should be presented to the eye at the same rate as the first. The number of each list remembered will furnish a measure of the memory power involved. Needless to say, the order should not be taken into account, as order involves association, while we are considering only retention and reproduction.

Relative power of sight and hearing memory.

Experiment.

Different varieties of memory may be classified under two general heads, — spontaneous and intentional. The spontaneous memory is strongest in directions corresponding to the peculiar mental habits of the individual. Some people recall dates without effort. Others can learn a page of poetry or prose by reading or hearing it once. People have been known who were able to repeat an address to which they had listened. Such phenomenal spontaneous memories are due to an abnormal condition of some portion of the intellectual system. If we do not possess a large share of this spontaneous memory power, we may as well be content with what we have, for by no known means is it capable of cultivation.

Spontaneous and intentional memory.

The essential difference between the spontaneous

and intentional varieties of memory lies in the fact that in the former images arise without mental effort, while in the latter there is a distinct effort of the mind reaching out after the image wanted, as any one knows who has scratched his head in a vain search for the image, that, like the will-o'-the-wisp, eludes him still.

Difference between spontaneous and intentional memory.

Ready memory. If the mind successfully completes the search in a short time, we say the person has a ready memory.

Tenacious memory.

If a person is thorough in his methods of acquisition, he is apt to have a tenacious memory.

Circumstantial memory.

In addition to these two kinds of intentional memory, the circumstantial and philosophic are most important. In the former every detail comes back to the mind. One of the most famous examples in literature is found in Shakspere's *Henry IV*, Part II, Act II, Scene I, where Dame Quickly tells Jack Falstaff the circumstances under which he promised to marry her. Often, in our courts, witnesses are called upon to testify who cannot tell their story at all unless allowed to tell it in their own way, with all the irrelevant circumstances.

The philosophic memory does not cumber itself with all the details, because there is no need of it.

A person who possesses this kind of memory will attempt to grasp only the great principles of a subject, as the minute details can then be evolved as effects from a cause, or by means of some of the other laws of association.

Philosophic memory.

Which of these two kinds of intentional memory would you prefer to possess? The difference in their real value may be tested by giving the same lesson to two persons, one of whom has received the proper training, the other uneducated. The latter will probably attempt to remember all the details in the order in which they are presented. The result will be that no particular thing will stand out prominently in his mind. All will be on a dead level, as it were, and one thing will be as easily recalled as another. The former will at once select the most important points and group the minor ones about them. He will burden his memory with the important things only, and they will stand out clear and distinct. When the examination is given, what may be expected of the two?

Problems.

Before we leave this subject we want to know what are the conditions of a good memory, and how we may be able to bring about those conditions, and so improve our memory power.

A good intentional memory depends largely upon

the number and ineradicability of the paths in the brain. That is to say, our habits in learning things determine the power of our memories. Associated with this condition are the readiness and distinctness with which images are recalled, and the length of time during which the impressions are retained.

Conditions of good memory.

Memory of childhood experiences.

We hear remarkable instances of memory images called up from the earliest childhood. Some people claim to have recollections of events that occurred in their experience when less than three years of age. It is highly probable, to say the least, that in such instances the memory has received suggestions from parents and friends in early life, and the imagination has seized upon the pictures presented and made them its own. My own earliest recollection goes back to the time when, a child of four, I ran away to school. I remember a part of the walk, but that is all.

Memory in ancients and moderns.

The memory of the ancients seems to have been much stronger than that of the moderns. The poems of Homer and other literary masterpieces were handed down from one generation to another by word of mouth. We depend upon books to keep the masterpieces for us, trying to remember only where we may find them, though

Macaulay is said to have been able to repeat the greater portion of the Bible from memory.

This would seem to indicate what as a rule for strengthening the memory? What is the value of books? Why is it necessary for us to depend more upon books than did the ancients? What tendency should we guard against?

Problems.

Again, we find cases where the memory power seems to be in a peculiarly exalted condition, where minute circumstances, long since forgotten, come suddenly before the mind. Persons who have been on the point of drowning tell us that in an instant the whole life, to the smallest, most trivial circumstance, is flashed before the mind.

Exalted memory.

What bearing does this fact have upon the subject of forgetting? Would it be well for us if we could recall every detail in our whole life at will? Why? Is a judicious power of forgetting an essential condition of a good memory?

Problems.

We have spent a good deal of time and space in a study of the laws and conditions under which the reproductive power acts, because a good memory is desired by every one, and in order to cultivate it we need to know first of all its nature and modes of action.

To improve the memory various systems have been devised, most of which may be dismissed very briefly.

First come the devices which are classed under the one name, mnemonics, the principle underlying all of which systems is, that memory consists in the reproduction of words instead of things.

Methods of improving memory.

From the earliest type, which taught the student to connect the facts to be remembered with different portions of a familiar building, down to the most modern methods of rhythmical sound or artificial association, these systems are of but little practical value. It is often, as any one may learn by experiment, more difficult to recall the intricacies of the system than to recall the facts that one wishes to remember. The only element of value contained in any of them is to be found in the training of the associative power.

Mnemonics valueless.

Then there are the mechanical methods, such as the older people now living will remember to have been in vogue in their early days. Learning things by rote as an exercise in memory culture is practically useless. Indeed, all mechanical and mnemonic processes may be discarded as valueless if we wish to develop a good memory.

Mechanical methods.

It is only by the observance of natural laws that we can attain our object. And yet it must be understood at the outset that there is a point beyond which each individual will find it impossible to advance.

Natural method.

The memory power develops up to a certain age, and remains stationary for a time, after which it gradually decays. The power of acquisition may continue to develop after the memory power has reached its highest state. A person of thirty years who has already mastered several languages can master another in less time and with less effort than a person of fifteen who is just beginning with his first foreign language, because he is assimilating the new to the old.

If we wish to put into operation the natural method of developing and cultivating the memory, we shall need, first of all, to take good care that the physical system be kept in sound condition. Good health is the best foundation upon which to rear an enduring memory superstructure.

Good health as a first condition.

Then we need clear percepts, and a habit of forming clear-cut images from these percepts.

Clear percepts and images.

Third, we should learn a thing thoroughly if we wish to remember it. Then we may assist the memory by various physical helps, such as reciting aloud, the sound of the voice forming a new memory path; drawing an illustration of what we wish to recall; frequent repetition to make sure that the path is not obliterated by other material; making abstracts of books or

Thoroughness in learning and other helps.

chapters read; conversation with others upon the subject.

Can you tell from your own experience whether any of these physical helps are of practical value? Can you suggest any other physical helps?

Problems.

Association with previous knowledge.

The fifth rule is: Habitually associate or connect a new thought with that which you knew before. This is one of the most powerful helps to the memory.

Coördination of ideas.

Suppose, for example, that you are studying history, literature, science, Latin, Greek, French, and German. You are constantly coming across new facts in each of these departments. As isolated facts, they are bound to escape you. If, however, you can take one central thought and connect the others with that, you will have little difficulty in holding at your command a large field of knowledge. Nearly everything that we can expect to remember from the time of Christ down to the present may be hinged upon a very few dates and events.

Illustration.

Just see how much in the above-mentioned subjects, and in art, philosophy, and religion, you can cause to cluster around the following: 476 A.D., the fall of the Roman Empire; 800, the empire of Charlemagne; 1066, the Norman conquest of England; 1453, the capture of Constantinople by the Turks;

1600, the Elizabethan age; 1700, the age of Queen Anne; 1789, the French Revolution; 1861, the Civil War.

The sixth rule is: Give your undivided attention to the acquisition of the matter in hand. Think about it, and, above all, and last of all, keep constantly at work. These rules might easily be deduced from what has been said in the preceding pages. You may be able to find still others, but of one thing be sure: you will never have a good memory, or anything else worth possessing, unless you are willing to spend some time and energy in acquiring it.

Undivided attention and constant work.

What bearing do these observations have upon the method, too common in many of our schools and colleges, of "cramming" for examinations? How much would a school or college course be worth if the student did all his work for the term or the month during the two or three days immediately preceding the examination? What advice would you give to your fellow-students concerning methods of study? Do you follow your own advice?

Problems.

CHAPTER IX.

IMAGINATION.

MEMORY we found to be the power of reproducing more or less exactly the experiences and percepts of the past in the form of images. Advancing one step, we find ourselves in the realms of the imagination, which, though differing from memory, is yet separated from it by no sharp line of demarcation. As in the case of memory, imagination and thought must have materials to work upon, and we have shown the only materials at the disposal of the mind to be sensations.

Imagination.

Imagination is the power which represents the elements of knowledge in modified forms and in new combinations. It seizes upon the percept of a man, and, combining with it some qualities which he may possess, constructs a "Lilliputian" or an inhabitant of "Brobdingnag," while the figure of a horse and the human faculties when combined give us the "Houyhnhnms" of *Gulliver's Travels.* It is a wonderful power, broader than simple memory, and only less wonderful than the logical faculty.

Definition and nature of its action.

Even in our percepts we find imagination occupying

no small place. I see before me on the desk an inkstand. The sensation produced by the inkstand comes from only one side of it, but the imagination supplies instantly a picture of the other side in order that the percept may be complete.

Imagination in perception.

When we hear the ringing of a bell, what part does the imagination play in forming the percept? How is your percept of a house modified by imagination?

Problems.

Imagination is also involved in memory. About ten years ago it was my privilege to visit Niagara. The things that I saw made such an impression upon me that I thought there would never be any difficulty in remembering them exactly as they are. And yet, when I returned for another visit a short time ago, I found that my imagination had been at work upon the images. Strangely enough, my last visit was far more satisfactory than the first, and the Falls seemed far grander and more awful than before.

Imagination in memory.

Can you give similar instances of image changes from your own experience?

Problem.

Let us begin our study of imaginative phenomena by an investigation of the processes by which the imagination works. The memory works under the laws of association, but imagination begins by dissociation. As a preliminary but essential step toward the weaving of its

marvelous fabrics, it pulls the images to pieces, analyzes them, separates them into their constituent elements. When this has been done, the separate elements are available for use as threads in the new product, and may be reassociated, by which process variations from the original are made.

Processes of imagination, dissociation, recombination.

Can you cite instances from the mythology of Greece and Rome in which images have been dissociated, and the elements of more than one reassociated, by the imagination? How would the picture of a man with the head below the shoulders illustrate these processes?

Problems.

There are three varieties of imagination which I shall designate as constructive, creative, and aesthetic.

Varieties.

The constructive variety, which is also sometimes called the intellectual imagination, is active during the acquisition of new knowledge. We really learn nothing, whether with or without the aid of books, without using the constructive imagination. A pupil who is studying geography, for example, will know the subject only as a series of names located on maps, and of facts to be stowed away in the mind long enough to enable him to pass an examination, but of no practical use to anybody, unless the teacher can

Constructive imagination.

help him to construct, out of the elements already in his possession, an image of the thing to be remembered.

Criticise the method of the geographers who begin their works with a description of the general features of the earth's surface, and tell where the study of the subject should begin. If you wished to describe to a child the battle of Quebec so that he would remember it understandingly, how would you go about it?

Problem.

In scientific researches the constructive imagination is of the greatest assistance. The scientist observes facts. From these facts he must construct his hypothesis concerning results. But these results are not as yet matter for observation. It is only by the help of the imagination that such results can be predicted. When Franklin observed the actions of lightning and of the electric spark and concluded that they were the same, his imagination saw them producing the same results, and found the means to prove his hypothesis correct.

Constructive imagination in science.

Give examples from the different sciences, *e.g.*, astronomy, chemistry, physics, physiology, showing how the imagination has been of service in making the great discoveries in those sciences.

Problem.

More powerful still, because coming before our everyday observation and experience, are the accom-

plishments of the creative, or practical imagination as it is sometimes called. From the bicycle to the steam engine or the electric motor, from the old hand spindle to the great cloth manufactories, from the wooden plow to the four-share steam or electric plow, from the sickle and flail to the harvester-and-binder, and from Franklin's kite and key to the horseless electric wagon — all the steps in the processes of practical development, whether in labor-saving devices or in the other devices that conduce to the comfort and luxury of modern life, have been made possible by the imagination, which pictured to itself an easier way of doing something, or a method of accomplishing greater results by the expenditure of the same amount of energy. Further, too, we might go. Modern education and educational methods, our schools, colleges, and great universities have been founded and maintained because of the fertility of imaginations which worked themselves out into results.

Creative imagination and what it accomplishes.

This variety of the imagination is very active in children. The boy who gallops up and down the street astride of a stick is just as happy as, far happier perhaps than, he would be if seated on a real horse. His imagination has clothed the stick with flesh. It is a real horse to him. The little girl who is so fond of her old rag

Creative imagination in children.

doll will care nothing for it when her imagination has ceased to make the doll a real being. You can, no doubt, give instances from your own early childhood of the intense reality of the images that you created. A large part of the life of the child is lived within the realms of the imagination. He sees everything through colored glasses, and takes great delight in the marvelous results produced. He is greatly pleased by stories of the remarkable, which stimulate his fancy to new flights, and he soon produces a story surpassing any that he may have heard. It is amusing to hear two children, each trying to outdo the other in singing the praises of his own favorite possession. Numberless illustrations of this phase of the subject might be given.

It is during childhood, too, that the imagination shows itself in the adaptation of means to ends. Show what part the imagination plays in the following incident.

Problem.

A child saw the sugar bowl standing in the center of the table. He was unable to reach it from the floor. Presently he pushed a chair to the side of the table, climbed up into it, and so reached the bowl and the sweets within.

While the creative imagination should be cultivated and stimulated to exercise in early childhood, it should be borne in mind that there is a grave danger connected

with it if uncontrolled, or allowed to develop into an exaggerated form during the later years of childhood.

Should be controlled and educated.

The youth who lives too much in romance is apt to be weakened intellectually and to be lacking in moral responsibility. In order to prevent such results, the imagination should be led, without diminishing its vigor or quenching its ardor, from the extravagant and improbable into channels which deal with the probable and the real. We need to cultivate the imagination to-day more than ever before, but in doing so we should avoid the extravagant and absurd. So much has been accomplished in the past that the tax upon the imagination is constantly becoming more severe, if we expect to advance beyond the mark that has been set.

We have yet to consider the variety of the imagination that is affected by the feelings — the aesthetic imagination. It may be said that feeling enters into all acts of the imagination, and it is true.

Aesthetic imagination and the formation of ideals.

But we may separate idealism from all other departments of knowledge, for the sake of convenience, and it is with the formation of ideals that the aesthetic imagination concerns itself. If we study the progress of historic ornamentation from its beginnings in the savage tribes down through the eastern nations, Egypt, Greece, Rome, and so on

to modern times, we may learn much of the character of the different peoples by means of their ideals as expressed in the principles of their ornamentation.

Ideals of children.

It is everlastingly true that "as a man thinketh in his heart, so is he"; for the ideals formed by the action of the aesthetic imagination are ever striving to work themselves out in action, and in this way character is shaped. The boy or girl who "wants to be just like papa or mamma" tries to become just like papa or mamma. The desire was the result of the formation of an ideal in the childish mind of all that is great and good as embodied in the character of the parent. Woe to the parent who does not furnish a good ideal!

Reaction of imagination upon feelings.

Not only does feeling enter into imagination, but the products of the aesthetic imagination also act upon and stimulate the feelings. The poet, the artist, the musician, the novelist, all appeal to our feelings by stimulating our imaginations. As we imagine ourselves in the artist's place, we pass through, more or less accurately, the emotions that stirred him when producing his work. Or we may throw ourselves into the work itself and become one of the actors in the shifting scene, the sympathetic reader, one of the puppets of the show, or all of them in turn.

Here opens the proper field of the critic. Only as we enter into fellowship with the artist, take his place in production, as it were, are we at all fitted to explain to others the beauties in his work; and only as we become for the time an integral part of the work produced can we point out the failures of the artist, if there be any, to reach the standard of good taste.

True criticism.

Somewhere within every human being there is a capacity for appreciating the good, the true, and the beautiful, a power of forming ideals. Most children of ten years have already formed ideals for themselves. The kindergarten is a powerful aid in this direction.

Power to form ideals universal.

We need to keep constantly in mind that, in all the range of imaginative products, there is nothing that is beyond the limits imposed by intellectual laws, nothing that is formed without materials. The only materials at the disposal of the wildest imagination are those same sense impressions that have haunted us from the very beginning of our study of this subject. Every imagination is limited in its scope by the abundance of the materials at hand, and the direction of the imagination is strictly determined by the range of the percepts that have been formed.

Products of imagination come from sense impressions.

While in the processes of the imagination there is a

tendency to stray from the strict paths of literal truth, there is yet no reason for the old notion that the special business of teachers should be to repress all imaginative tendencies. We are apt to consider only the vagaries of this faculty, and then to condemn the faculty as useless, whereas it may be made to minister to the highest that is in us. It tends to foster the belief that its own products are either true or capable of being realized as true, and so it becomes the practical power which is at the basis of all progress.

Mistake often made.

We have thus far omitted one subject which may well be touched upon briefly, — the effects of the imagination upon the physical system. It is a well-established fact that the health may be materially affected by imagining one's self to be either well or ill. Well-authenticated instances are recorded where people have been made ill by being told how ill they looked; and, on the other hand, people have regained health and spirits through the medium of an imagination worked upon by the suggestions of others. Many instances of so-called "faith cures" are effected by the power of imagination.

Imagination and the physical system.

Everybody knows that warts may be cured by tying three knots in a string and throwing it away, or by drawing a pencil mark about them.

Example.

Should these remedies fail, you doubtless know of one that is infallible.

Problem. In what does the chief value of many patent medicines consist?

The imagination may even cause death, as in the case of a French criminal. The man had been condemned to death by the courts. Before the time for the execution, the doctors were given permission to try an experiment upon him. They informed the man that he was to be executed by having his veins opened, and that they were ready to perform the operation. The prisoner was blindfolded, stretched on a table, and, a harmless incision having been made in his arm, warm water was allowed to trickle down the arm and fall into a vessel. The attendants remarked freely upon the flow of blood and the condition of the pulse. The prisoner's condition was observed to follow closely the tenor of their conversation, and the man actually died because he imagined that he was dying.

Illustration.

Without multiplying instances, we find that in the imagination we have a mighty power, one that should be handled carefully, developed in the right directions, and made to do us great and valuable services.

Imagination a mighty power.

How are we to cultivate the imagination in the right

way? As already hinted, the first thing to do is to collect an abundance of perception material. The person who shuts himself up in a room away from the world and his fellows can never have a healthy imagination. If Bryant and Longfellow and Wordsworth, and all the other poets who have written such beautiful things about nature, had never seen the world around them, never formed clear percepts of what they saw and heard, they could never have written their poems, and the world would have been so much the poorer. He who would write of human life must study that life at first hand and through as many types as possible.

How to cultivate imagination: collect materials.

Even if your imagination does not lead you into the paths of literature, you will still need a large number of percepts; no matter what your occupation in life may be, the larger the number the better for you. And there is an abundance of percept material at hand. Any one of us needs only to open the eyes to find them resting upon materials for imagination work: the grass, the flowers, the trees, the birds, the stars, — all things may be used if we will only use them.

Universal need of cultivating imagination.

Of what use is a cultivated imagination to a farmer? to a grocer? to a hod-carrier?

Problems.

After the collection of materials in importance comes

the habit of forming clear images. Giving an oral or written description of the things that you perceive will assist greatly in making the images sharp and clear.

Image clearly.

When the images are clearly defined, begin to dissociate them, removing one salient feature at a time, and considering the part removed and that which remains each by itself.

Dissociate carefully.

Then try putting the parts of two images together, so combining them as to form something new. The practice of these processes of analysis and synthesis will give you control over your imagination, and increase the variety of the imaginative products at the same time.

Practice reassociation assiduously.

It may seem to the casual observer that these recommendations will serve only as a kind of superficial imaginative gymnastics to develop a purely mechanical imaginative product. Many people object to the deliberate, conscious practice of imaginative exercises, but it may well be questioned whether, when the principle involved is acknowledged to be correct, it is not advisable to train the imagination deliberately and in accordance with the laws of its development, instead of trusting to chance. It is clear that the latter way is the more agreeable, and it is acknowledged that it has proved successful in many well-known instances.

Objections.

The reproduction in your own mind of an image formed by some one else has but little value in strengthening the imagination. Why? **Problems.** Which do you think better for the imagination of theater-goers, to have all the artistic scenic effects that we find on the stage to-day, or to have no scenery at all, as in Shakspere's time, when placards were hung out to announce changes of scene?

The reading of poetry and other imaginative literature may serve as a stimulus to imaginative activity if properly used, but it should never be **Need of original work.** allowed to supersede original work. Produce something of your own each day, and you will find it far more helpful than reading. A good way to make reading helpful is to stop reading in the middle of a story and finish it for yourself. The chief charm of Stockton's *Lady or the Tiger* lies in the powerful stimulus to the imagination, which will insist upon finishing the story now in one way, now in another. When you come across a figure of speech, select a figure of your own to take the place of the one given by the author. For example, what other form of expressing the thought contained in the following lines from Longfellow's *Evangeline* can you suggest?

Silently, one by one, in the infinite meadows of heaven,
Blossomed the lovely stars, the forget-me-nots of the angels.

Need to form ideals and to strive to attain them.

Finally, each should place before himself an ideal, with the determination to reach it. We fashion our ideals out of the qualities and characteristics that we find exemplified in the lives of others, and then we are in turn molded by our ideals. No one can be anything worth the while without first forming an ideal of that which he would become. Emerson says, "Hitch your wagon to a star." This is sound advice, especially if we couple with it the Massachusetts farmer's version of the words as he remembered them, — "Grease your wagon before you start"; in other words, collect the provisions for the journey, and keep a sharp eye upon the scenery along the way.

CHAPTER X.

THOUGHT.

THE third of the representative powers is thought. Perception, memory, and imagination are conditioned by, and concern themselves with, concrete materials. When we perceive, it is an object we perceive — a tree, a horse, *i. e.*, some particular tree, some particular horse. Memory and imagination conjure up before us an image, but still the identity between this psychical object, or image, and the physical object may be established.

Summary.

Thought, though a representative power, differs from the others in that it deals with the abstract, or the relations between objects and ideas.

Thought.

We may define thought as the power which compares things and detects resemblances and differences. The person who saw fire for the first time might get burned. Memory would tell him to let fire alone thereafter, but it would be only by exerting the power of thought that he could make this source of pain and danger useful.

Thought defined.

It is still maintained, by some students who ought to know better, that children do not think. Indeed, some say that the thought power begins to develop only when the child reaches an age varying from ten to fourteen years. As a matter of fact, the power of thought is exercised from the early years of childhood, though it comes to full maturity last of all the intellectual powers. Hold a piece of sugar before the child. He says "goo'! goo'!" The child is thinking, and is expressing his thought. Elaborated into language, the train of thought would be somewhat as follows: Whatever produces a pleasurable taste sensation is good. Sugar always produces a pleasurable taste sensation. Therefore sugar is good. Now, this substance before me is sugar. Therefore, this substance before me is good. Quite a complicated thought process! The first "why" of the child indicates that the thought power is active.

Thought begins to develop from the earliest childhood.

Indeed, it is impossible to perceive without thinking. When I perceive the ink-well on my desk, I separate it from the desk and think of it in the relation that it bears to the desk. Otherwise I could not perceive it as an ink-well. The child does the same.

Thought involved in perception.

In memory, too, the thought power is present as an active agent. If I attempt to call up an image of the

house where my friend lives, I can do so only by separating that house from those immediately surrounding it by some characteristics which the others do not possess. This is thinking, and a kind of thinking that is carried on quite early in life.

Thought and memory.

In imagination the thought power is also present. The man whose imagination is at work upon some machine that he hopes will be helpful to his fellow-men must spend much time in vigorous thought upon the relations of one part of his machine to another, and upon the relation of the whole to the work that he wishes it to do.

Thought and imagination.

The processes of thought are three in number—conception, judgment, reasoning.

Processes of thought.

What kind of an image does each of the following words call up in your mind: horse, dog, church, tree, boat?

Problem.

Whatever the particular image called up by the word "boat," for example, whether it be a rowboat, a full-rigged ship, or an ocean liner, or whether it be no boat in particular, the word "boat" should mean to us an object possessing a certain few qualities which separate it from all other classes of objects. This forming of a general idea is called conception, or thought in the form of analysis.

1. Conception.

Let us examine a little more carefully the method by which we arrive at the concept "boat." The first step in the process is observation. We examine carefully all the specimens that are accessible, flat-bottomed and round-bottomed, skiffs and whaleboats, yachts and barges, sloops, schooners, brigs and ships, sailing boats and those propelled by steam and electricity. The more varieties that we can observe, the nearer perfect will be the concept that we shall form.

Method of forming a concept: (a) Observation.

In the second place, we compare all these specimens in order to find out all the points of likeness and difference in size, shape, rig, materials, etc.

(b) Comparison.

The third step will be abstraction; that is, we draw off (*ab* = from and *traho* = draw) the characteristics that we find to be common to all the specimens that we have observed and compared.

(c) Abstraction.

Problem. What qualities would you abstract in this case?

Fourth, we proceed to a generalization, by which we mean the grouping of the common characteristics in a class by themselves, separated from all other classes by their applicability to all the specimens.

(d) Generalization.

Lastly, we proceed to name the class. This naming is a matter of convenience. By means of names

we can pass concepts more rapidly in review than would be possible if we were obliged to call up all the common qualities every time.

(e) Denomination.

Owing to the fact that it is generally well-nigh impossible to observe every specimen belonging to a class of objects, our concepts are not often perfect. For many years the concept "swan" included the quality "whiteness." When the black swan of Australia was found, the concept had to be modified. As our observation increases, the concepts that we have formed must be modified to meet the changed condition of affairs. The concept of the word "man" which the child forms at first is apt to include the quality "whiteness" and a certain definite idea of size. As the child observes men of different races, such as the Chinese, the Indian, the Negro, his early concepts undergo a change, and with each change he draws nearer the true concept.

Modification of concepts due to larger experience.

How does the concept of the child differ from that of the grown person? How would the concept "boat," formed by the Indian of 1400, differ from that formed by the American of to-day? Give instances in which your own concepts have changed during the past year.

Problems.

It is of great importance that we form accurate concepts, for all the higher forms of knowledge depend

upon the degree of perfection reached here. One writer says: "There is nothing in which men fail more than in forming distinct and accurate conceptions, and no more defective education than that which encourages mere knowledge of words, rules, and formulae, to the neglect of ideas."

Need of forming accurate concepts.

Some one may think that there is but little difference, if any, between a concept and an image, and that, if care be taken to form clear images, the concepts will take care of themselves. Note, however, the distinction. An image is always the reproduction of some concrete thing in more or less accuracy of detail. You cannot form an image of greenness, but only of a green object. Greenness is an abstraction, and all concepts are abstract notions, as distinct from the concrete notions embodied by memory and imagination. In the course of its development the abstraction at first attaches itself to an individual object, then to a class of objects, and finally to a combination of classes.

Difference between concepts and images.

An abstract notion or idea is acquired through the medium of the senses, though it is not directly capable of being perceived. No one ever perceived greenness through the senses. We have seen many green objects, and this common characteristic has

Abstract ideas.

been abstracted, drawn off from them, and made a quality.

How do we get our ideas of hope, fear, courage, gentleness, etc.? May an abstract idea be a concept, and, if so, under what conditions? Is it generally true that a concept consists of more than a single abstract idea? Demonstrate the truth of your answer. May we conclude from our answers to these questions that an abstract idea would mean the same thing to all persons? How much influence would our surroundings exert upon the formation of abstract ideas? Compare the abstract ideas of an inhabitant of "darkest Africa" with those of a cultured American.

Problems.

It is well to remember that words, as commonly used, may have two significations. The word "animal," for example, may mean the qualities which distinguish a certain object from the vegetable and mineral kingdoms. This is called the intensive meaning of the word.

Two significations of terms: 1. Meaning in intension.

On the other hand, the same word may be used to designate any member of the animal kingdom, from man down to the smallest insect. This is its meaning in extension. These two meanings of words are very convenient in forming concepts. As we subdivide the class, we find that the number of qualities which belong to each subdivision

2. Meaning in extension.

becomes greater. If we should substitute the word "feline" for "animal," we should greatly limit the extension, but the intension would be increased, because the number of qualities necessary to define the cat family would be much greater than those which would designate animals, though the individual members of the cat family would comprise but a small part of the animal kingdom.

Problems.

At what stage in the formation of concepts are we especially concerned with the intensive meaning of terms? At what stage with the meaning in extension? What general law may be formulated concerning the relation of extension to intension, and *vice versa?*

II. Judgment.

The second process in thinking consists in the formation of judgments. The word "judgment" is used in so many senses that we shall need to define the sense in which we propose to use it. It is often used in the sense of making up one's mind, coming to a definite decision.

Judgment defined.

In logic and psychology the word is to be defined as a statement, or proposition, consisting of a subject and a predicate. The subject and predicate may represent objects of presentation, of memory, or of conception, which are placed over against each other and joined by the copula.

In contrast with conception, which we characterized as thought in the form of analysis, we may say that judgment is thought in the form of synthesis. Thus every judgment implies a comparison. When I say, "The horse is useful," I have pronounced a judgment — the judgment being that the two objects compared, the horse and useful things, agree.

Judgment as synthesis, implying comparison.

Does agreement imply identity? The statement that man is not immortal pronounces a judgment of disagreement between the objects compared. Illustrate judgments of agreement and disagreement, using sense objects, images, and concepts in both subject and predicate.

Problems.

It will be noticed that before judgment can be rendered, that is, before a statement of agreement or disagreement can be made, there must have been observation and memory. Can you show this to be true from the above examples or from those of your own making? I draw a line on the board and ask you how long it is. Upon what does the accuracy of your answer depend?

Problems.

Although psychology has, strictly speaking, nothing to do with the truth or falsity of the judgments formed, each being a mental act equally with the other, it is yet within our province as students of the human mind to

inquire what is the condition of the mind in the two cases, and why one judgment is said to be true, another false. Though our perceptions be perfectly accurate, and though the images formed by memory be exact reproductions of things observed, if, when two objects are placed over against each other and the statement of the relation existing between them is made, this judgment does not agree with that which we have heretofore considered to be true, the judgment is pronounced to be false.

Why one judgment true, another false.

Illustrate this by the common opinion about the theory of evolution, by the treatment accorded the theory of the rotundity of the earth during the fifteenth century, by the treatment of Galileo, Kepler, and Sir Isaac Newton. Note in all these and in similar cases that nothing is said about the truth or falsity of the percepts, or images, but only of the relation said to exist between these percepts and images and the body of what was supposed to be real knowledge.

Problems.

If, then, our present judgments do not agree with our former judgments, we find it necessary to change either the one or the other. This is but another way of repeating that the mind tends to act as it has acted before, that paths of action become worn, and

any departure from these worn paths becomes increasingly difficult. As a result, when new ideas that cannot be assimilated to the old ones present themselves, we are apt to pronounce any judgments made concerning them that do not harmonize with our established judgments to be false.

The mind tends to act as it has acted before.

This necessity of harmonizing the judgments that we form to-day with all those made heretofore and stowed away in the mind, makes it a difficult matter sometimes to arrive at a correct judgment.

Difficult to form a correct judgment at times.

Show how this has been true in the case of judgments about steam as a motive power. How has the difficulty been apparent in the development of electrical science from the time when electricity was supposed to be a quality of amber (Greek, *electron*) down to the present?

Problems.

We may easily show, by tracing the development of any industry, that it is this constant comparison of concepts and the readjustment of their relations to one another that constitutes progress.

What constitutes progress.

The conditions or states of the mind with reference to judgments, so far as we need to consider them, are three in number. First, the mind judges, and when

the judgment is stated the mind looks upon it as a truth. This condition we call belief. There are times, however, when a judgment that we have formed is found to be out of harmony with previous judgments and with generally accepted truth. In this case the mind reviews the judgment, holding the statement of the relation between two concepts in suspense for more extended examination. In this instance the mind is in a state of doubt. Again, a stated judgment may have all the evidence in its favor, and yet we may be unable to reconcile it with our own previous knowledge. Here we have the condition of unbelief.

States or conditions of mind with reference to judgments.

Problems. Give an illustration of each of these three conditions. Can there be such a thing as universal doubt? Why? Can we disbelieve everything? Why?

The first judgments of childhood are intuitive, with no defined relation to what has gone before. This intuitive formation of judgments lasts until the body of knowledge gained is large enough to overshadow and regulate succeeding acquisitions. Curious answers to the question "Why?" are given by children who have not learned to view things in their proper relations.

Intuitive formation of judgments.

Most of our judgments, however, are reached by

inference, formed from other judgments. The formation of judgments by inference is called reasoning, which is the third of the thinking processes. We are reasoning in one way or another nearly all the time. I look out of the window and say, "The sun is shining." I cannot see the sun; my judgment is an inference. Stated in full, it might read something like this:

Judgments formed by inference.

III. Reasoning.

Whenever I see a certain bright light on the leaves, the sun is shining.

I see that bright light on the leaves.

Therefore, the sun is shining.

We do not need to state the propositions upon which our conclusions are based in order to reason. Implicit reasoning, as it is called, is by far the most common kind, but it may always be made explicit if we choose. It will be noted that in reasoning there is always present a universal element, indicated in the above example by the word "whenever."

Implicit reasoning.

All inferential reasoning may be divided into two classes, — inductive and deductive.

Reasoning by induction is passing from the particular to the general, from the cases observed to the general law. For example, it has been observed in the past that one generation of men

Inductive reasoning.

has died, to be succeeded by another, which died in turn. From these observations of the past, relying upon our belief in the uniformity of nature, we draw the conclusion that all men now living, and all that may be born hereafter, will die.

Our general law will be liable to error in proportion to the degree of imperfection in our induction. To make a perfect induction, we must observe every possible case. If, for instance, I observe all the articles lying on my desk and make a general statement about them, — the ink-well is useful; the pencils are useful; the pens and the paper are also useful; therefore, all the articles on my desk are useful, — there is no chance for error.

Perfect induction.

But, in the nature of the case, perfect inductions are rare, because we cannot examine every case to which the general law might apply. Even in our common everyday life we reason by imperfect inductions, as when we go to a store to purchase food, clothing, or fuel. We could not say that the food would nourish, the clothing warm, or the fuel burn, until we had observed this particular food, clothing, and fuel, unless we inferred it from former experiences.

Perfect inductions rare.

Give examples of perfect and imperfect inductions.

Problems. What is the difference between induction and generalization as we studied it under conception?

The examination of both inductive and deductive reasoning properly belongs to the science of logic, but we are concerned with them here to the extent of ascertaining the underlying principle upon which the mind rests in drawing inferences. It should be apparent from the illustrations given that the underlying principle upon which all our inductive inferences are based is a belief in the uniformity of nature. This principle may be stated as follows: We believe that what is true of anything to-day will be true of the same thing or anything like it at any other time, if the conditions remain unchanged. Upon this belief, or some modification of it, all inductive reasoning is based. Even more than this may be said. This general truth, in which everybody believes without proof, is the great axiom from which all other general truths are derived.

Underlying principle upon which induction rests.

Deductive reasoning begins where inductive reasoning ends, with a general law. Having observed that the case in hand belongs to the class about which the general law is stated, we proceed to apply the law to this particular case:

Deductive reasoning.

All men are mortal.

John Jones is a man.

Therefore, John Jones is mortal.

This is reasoning from the general to the particular.

All deductive reasoning may be described as reasoning by comparison. In the example the unit of comparison, technically known as the middle term, is man. A man is a mortal being; John Jones is a man. John Jones and a mortal being are each compared with man, and since both agree with man they must agree with each other: therefore, John Jones is mortal.

Reasoning by use of a middle term or unit of comparison.

How is the axiom "that things that are equal to the same thing are equal to each other" derived from the belief in the uniformity of nature?

Problem.

Units of comparison are concepts, and our ability to reason well depends upon the number of clear concepts that we have at command. We must here note one point that is apt to escape observation. These units of comparison that we make use of in reasoning are an expression of our standards. If I argue:

Units of comparison are concepts, and are used as standards.

All gambling is immoral.

Playing cards for prizes is gambling.

Therefore, playing cards for prizes is immoral, —

I have in my mind a definite standard.

This standard may change, too, with advancing years and with the advance in civilization. My standard of pleasure to-day is not what it was when I was a child. An

Standards change both in individuals and in peoples.

argument in which pleasure was the unit of comparison, that would have had weight with me then, falls without effect now. The idea or standard of morality which might be used by a cannibal as a unit of comparison could hardly bear the test of our civilization.

Give examples to show the change in standards due to advancing years, civilization, religion. **Problem.**

The object of reasoning, the reason for which we have been given this power, is that we may arrive at new knowledge by a shorter route than by the tedious process of observing every case that may arise. **Object of reasoning.**

While this is true, it is also true that we are apt to form inferences too hastily, to jump to conclusions without sufficient examination of the data upon which the inferences are based. For example, consider the peculiar political conditions in the United States from 1892 to 1896. In the former year a national congress was elected in which one of the great political parties had a substantial majority. Then came the hard times. In 1894, when another congress was elected, the party in power was turned out, an overwhelming majority of the opposing party being elected. But times grew worse instead of better, and in 1896 another revolution took place. The administration and the congress received the blame for the **Hasty inferences.**

hard times. The voter jumped to the conclusion that those men were responsible, overlooking all the influences that were bearing on conditions of trade, etc.

Problems. Give other examples. What kind of reasoning was used by Franklin in his great discovery? what by Sir Isaac Newton? what by Fulton? what by Edison?

Auxiliary principles of thought. In addition to the general underlying principle stated above, we may, for the guidance of the student in thinking, enunciate three auxiliary principles. First, everything is or is not. We cannot say that a rose is either red or blue, but we can say that a rose is red or not red, the "not red" including all other possible conditions except that of redness. Second, there is no such thing as being and not being at the same time. A man may be alive or not alive. He certainly cannot be alive and not alive at the same time. Third, everything is always what it is. A rose is always a rose; redness is always redness, no matter what the conditions may be.

Principal thought relations upon which inferences are based. In the three processes of thought — conception, judgment, reasoning — we have found that the important thing to be considered is the relation which one object, image, or concept bears to another, as on the relation grasped by the mind depends the conclusion or new

fact at which we arrive. That the student may find it easier to understand the thinking processes, it may be well to mention some of the most prominent relations, though they are perfectly familiar. These relations are relations of time, space, cause and effect, whole and part, unity, diversity, quantity, and design. Many philosophers maintain that these ideas are intuitive; that is, that when we see a new object the relation at once suggests itself to the mind and is accepted as axiomatic. Others maintain that all these general relations come to us only through experience. There are many good arguments on both sides. We may feel free to use the relations without entering into the discussion.

Do animals reason?

The question is often asked, Do animals reason? The intelligence of some animals is so great that it seems impossible to deny that they have the reasoning power, and yet, on the other hand, to say that animals can reason seems to carry with it so much by implication that we hesitate to make the statement. Many times have I seen a dog attempt to catch a woodchuck by running straight to his hole, or burrow, when he saw the animal at some distance from it.

Problem.

Give any examples of the wonderful intelligence of animals that may have come under your observation.

Now, let us see if we can give a satisfactory explanation of these cases. The dog had chased the woodchuck many times, and the chase had ended abruptly by the disappearance of the animal in the hole. Now, when the dog saw him at a distance, the images of his former experiences chased one another through his mind with great rapidity. Of course the last image was a picture of the hole and the woodchuck together. Acting on this association of images, the dog went to the hole at once by the shortest route. Can you not explain all cases of animal intelligence by this rule: Animal reasoning is simply action resulting from the association of concrete objects?

Explanation of animal reasoning.

The difference between this kind of reasoning—associational reasoning, if we may call it such—and the reasoning of the human being, which applies the concrete and the past experience to the abstract and the unknown, which uses not merely the association by similarity based on the past but also detects the slightest association where all seems to be dissimilarity, and carries its processes through intricate data and long spaces of time with the greatest tenacity of purpose, is so great as to be immeasurable.

Human reasoning compared with associational reasoning.

CHAPTER XI.

FEELING AND EMOTION.

We now proceed to examine the second of the great functions of mind — the sensibility — through the phenomena which are called feelings.

Sensibility.

Feelings stand as a sort of connecting link between knowing and doing, furnishing the purpose, or desire, or motive which leads us to volitional activity. The sensibility is thus a purely subjective faculty, individual, personal. It is also a very important function of the human mind, because it does stand between the knowing intellect and the acting will, securing the interested attention until knowledge is consummated in action.

Feelings.

Feeling may be defined as a mental state of pleasure or pain, using these terms in a very broad sense. Nearly all our mental states may be placed in one class or the other, very few being indifferent or neutral. Some one may say, "I am utterly indifferent whether my neighbor wears a becoming bonnet or not." We may well answer to such a statement, "If you were indifferent you would never have known that the bonnet

Feeling defined.

was either becoming or unbecoming." The agreeable or the disagreeable enters so very closely into all our experiences that we may safely leave the neutral state out of the account.

Sensations and feelings.

Some sensations have been termed feelings, but there should be no danger of confusing the two. For the benefit of the young student we may indicate a method of distinguishing feelings from sensations. We found, when studying sensations, that they are always referred to some definite locality, but we cannot localize feelings. Furthermore, sensations are directly productive of feelings.

Pleasure and pain.

Pleasure and pain would seem to need no definition. The one is an agreeable, the other a disagreeable state, related to each other by contrast. It is often said that pleasure is absence of pain, —as if pain were the necessity of our being,—in the constant fight to ward off which we win more or less of the negative state of pleasure in proportion to the degree of our success. Systems of education in which this idea held a prominent place have flourished in the not far distant past. Indeed, we are only just learning that pleasure is the normal state, and that it is through our disobedience to some law of our nature that pleasure gives way to pain.

Upon what conditions do our states of pleasure or pain rest? The answer is to be found by examining the stimuli that produce these states.

Conditions of pleasure and pain.

First, let us vary the intensity of the stimulus. The moderately sour taste of an apple produces a sensation which results in a pleasurable feeling, while the same kind of sensation produced by the more intense stimulus of vinegar arouses a disagreeable or painful feeling.

1. Intensity of stimulus.

Give other examples illustrating feelings aroused by sensations from each of the other senses. What would be the feelings aroused by more and less intense thought? Illustrate.

Problems.

We may state as a general law that moderately intense stimuli produce a state of pleasure, while the same stimuli of excessive intensity produce states of pain. This law is really but another way of saying that a nerve when exercised gives pleasure, but when overworked rebels.

Law of reaction to stimuli.

Second, we may vary the form of the stimulus. The following is one of the easiest and most satisfactory experiments to illustrate the difference in mental states produced in this way. Strike several keys on the piano at once. The feeling, which is the resultant of the sensation

2. Form of stimulus. Experiment.

produced, will be pleasurable or painful according to the harmony or discord of the sounds; that is, if the vibration numbers are at such intervals as to produce a more or less distinct "beat" we are disagreeably affected.

Is there any explanation of the reason why a "beat" should be disagreeable?

Problem.

Third, we may vary the kind of stimulus. In case the stimulus is prolonged, we experience at first a pleasurable feeling, which is continued until the sense becomes fatigued, when the pleasure changes to pain. If, however, before the point of fatigue is reached, a stimulus of a different kind is introduced, there is none of the disagreeable feeling resulting from fatigue. In this way the pleasure may be indefinitely prolonged. This, of course, presupposes that the feeling aroused at first is agreeable.

3. Kind of stimulus.

Furthermore, we may superimpose one stimulus upon another as a variation in kind. For example, I have the toothache, and the painful feeling resulting is intense. Suddenly I hear strains of soft, sweet music. I am so delighted with the music that the pleasure banishes the pain.

Superposition of stimuli.

The habits that we have formed also modify our states of pleasure or pain. The man who has the smoking habit, for example, is in

Habit and pleasure or pain.

a state of pain all the remainder of the day if deprived of his after-dinner cigar.

Give other illustrations. Does this apply to mental as well as physical habits? **Problem.**

Having noted the general aspects and conditions of feelings, we come to the separation of feelings into varieties. This may best be done by taking into consideration the sources of the feelings. **Varieties of feelings.**

The first variety will be sense feelings — those resulting from sensations. Feelings arising from sensations of taste and smell affect us more powerfully than we are apt to think. So strong are these feelings that we apply the names of the sensations, as bitter, sweet, to experiences and feelings having nothing to do with taste or smell. Touch sensations produce agreeable or disagreeable mental states under varying conditions. Thus, in summer we like to come in contact with cool substances, while warmth is disagreeable; in winter only warm substances produce agreeable feelings. The sensations produced by contact with soft, smooth, yielding substances are generally agreeable. Most people are fond of stroking fur. The pleasures and pains resulting from sound sensations correspond to the musical or unmusical nature of the sound. All noises are disagreeable in their nature, all musical **1. Sense feelings.**

tones agreeable. We may note also the difference in the effects produced by low, regular tones and the higher notes, and by slower and quicker movement; in the one case soothing and serious, in the other vivacious and exciting. Doubtless we derive more pleasure from the sense of sight than from any other; that is, the proportion of pleasurable to painful sensations is greatest through this sense. We speak of warm and cool, of quiet and loud colors, and we appreciate the effects produced by the endless combinations of exquisite tints.

We must remember, however, when thinking of sense feelings, that they are not simple. There is all the time accompanying them an image of past feelings, which image modifies the effects of the present sensations.

Sense feelings not simple.

The second variety of feelings is that resulting from ideas—emotions. Emotions, it will be observed, differ from sense feelings in their source, which is the re-presentative faculty, the sense feelings being aroused by presentation. Emotions are, therefore, far more complex in their nature than the agreeable or disagreeable states of mind that we call sense feelings.

2. Emotions.

Emotions differ from sense feelings also in the period of time covered by their rise and subsidence.

The child falls and bumps his head. The painful feeling is soon gone and the child is happy again; but the child, startled into sudden fear, cannot recover from the effects so soon. In fact, he may never recover his normal condition. The emotion takes time both for its development and for its retirement, as it is a complex product of feelings and images of feelings.

Emotions and sense feelings compared.

There is, from the very nature of the case, a tendency in feelings and emotions to react upon each other. When the feeling and the image called up by it have produced an emotion the tendency is to strengthen the feeling, which, in turn, intensifies the emotion. For example, a pain in the groin may be associated with such images as to produce fear of appendicitis. This fear will tend to react upon and intensify the feeling of pain. As the painful sense feeling is thus reinforced, the emotion is also intensified, until relief comes or collapse ensues.

Feelings and emotions react upon each other.

Emotions may be strengthened by expressing them, while by carefully repressing all expression we may greatly weaken if not kill the emotion. The most skillful actors find themselves really apt to feel the emotions that they express upon the stage.

Effect of expressing an emotion.

What is the practical value of the advice often given to children to "count ten before answering, if you are

Problems.

angry"? What do the expressions "working himself up into a passion," "nursing his wrath to keep it warm," "stifling fear," "swallowing his wrath," etc., mean?

Natural physical expression of emotions.

There is a natural expression of emotions by the body, whether by contortion of the features, posture, or attitude.

Problems.

How is joy expressed in the face? In the accompanying figure what change in expression results from the



Fig. 24.

downward curve to the upward curve? Describe the appropriate physical expression of fear, pride, hatred, grief. What would be the natural effect of following Hamlet's advice to his queen mother, "Assume a virtue, if you have it not"?

Emotions exert a powerful influence upon our ability to think. Intense emotion, whether pleasurable or painful, suspends for the time all power to think connectedly.

Effect of emotions upon thought.

We sometimes hear that a person was "carried away by his feelings." What does it mean? What did Festus mean when he said to Paul, "Thou art beside thyself; much learning doth make thee mad"? (Acts xxvi, 24).

Problems.

But a moderate degree of emotion stimulates the power to think well. For instance, a lawyer who believes that his client is the innocent victim of persecution can think far better than if he had no feeling of sympathy. The kind of emotion will lend its own color to the thoughts produced under its influence. Pleasant emotions will tend to produce bright, happy thoughts; fear, anger, or jealousy will stir up thoughts corresponding to their own lines of action. Personal interest, egoism, prejudices the thought. As some one has said, "Many of us, on account of the interference of emotions, are willing to declare that two and two make five, while others cannot account for the sum being more than three."

Moderate emotion stimulates thought.

Illustrate the foregoing principles from your own experience if possible. Why is it often possible to read a person's thoughts in his face or action?

Problems.

Any classification that may be attempted is attended with difficulty, not only because of their complexity, but also because of their interrelations with one another. For this reason no classification has yet been proposed that is superior to that usually found in the text-books of the psychologists of the old school. The new psychologists, many of them at least, do not attempt a classification, and as a result the student is very apt to be uncertain what to think. That we may avoid this condition we shall classify the emotions, with the understanding that no such classification can be exact, and that any emotion placed in one class to-day may present phases to-morrow that would lead us to put it in another class.

Classification of emotions difficult.

I. Egoistic emotions, which may be defined as those centering in self. We may classify under this head any emotion that prompts us to act for our own advancement, or that prompts us to escape from anything that would injure us.

Egoistic emotions.

Mention some emotions that you would classify as egoistic. Do you think there is any need of cultivating the egoistic emotions, or may we leave self-preservation and advancement to instinct? What gave rise to the proverbial expressions, "If you don't take care of yourself, nobody will," "The Lord helps

Problems.

those who help themselves"? Why is it that we do not look upon an action done by ourselves as severely as upon the same action when done by another person? Do you see any signs that people are growing impartial in their judgment of their own acts and those of others, and if so, what? What can be said about civilization until perfect impartiality is reached?

II. Altruistic emotions, which are directed toward others. Altruistic emotions, the principal ingredient in which is sympathy, a feeling with others, constitute the foundation upon which the structure of civilized society has been reared. It may be seen by analyzing sympathy how close the relationship between the classes of emotions really is. We truly sympathize with another only when we are able to put ourselves in that other's place, and make, for the time being, his experiences our own. This shows sympathy to be a complex form of an egoistic emotion. It is this possibility of putting ourselves in another's place that has inspired all the noble acts of charity of which, if we would see the monuments, we have only to look about us. The more enlightened we become, the more we look upon mankind as a brotherhood, the oftener shall we put ourselves in others' places and enter into their experiences, and the more fully developed will be the emotion that moves the world.

Altruistic emotions.

Mention some emotions that you would call altruistic. Show why it is necessary that two people have similar tastes and experiences in order that they may enter into the closest sympathy. Can we be sorry for another without sympathizing with him? Show how memory and imagination enter into an altruistic emotion, *e.g.*, love. Why is it easier to sympathize with one who is dear to us than with any other person? Why do we build hospitals, asylums, colleges, etc.? Do you think there is any danger that too much sympathy with others will ever be developed?

Problems.

Development of sympathy.

We may ask ourselves whether the development of altruism is a good thing, and if we decide that it is, what is the best method of intelligently developing it. No person can hope to develop sympathy with others by shutting himself away from his fellows. It is only by moving among those who are in need of sympathy that interest in their welfare is aroused. The miser, the recluse, the only child of indulgent parents, cannot be expected to be thoughtful of the needs of others, or to enter heartily into their joys and sorrows. By carefully observing the needs of others, by stowing them away in the memory, by thinking them over and imagining them applied to one's own case, one can develop the finer social traits.

III. Intellectual emotions. Egoistic emotions may be said to be largely instinctive in their nature. Altruistic emotions deal with the concrete. We sympathize with a person, or, it may be, with an animal, as is shown by the existence of Audubon societies and other associations for the prevention of cruelty to animals. Many of the lower animals share in these two classes of emotions. In intellectual emotions, however, we rise from the concrete into the regions of the abstract. From the very nature of the case we shall hardly expect to find intellectual emotions highly developed in children, or, indeed, in any one who has not received sufficient education to develop an appreciation of intellectual, aesthetic, or moral abstractions.

Intellectual emotions.

The underlying principle or motive power in all intellectual emotions we shall find to be curiosity, the desire to learn more than we know at present. When developed to the highest extent, the resultant emotion becomes love of knowledge for its own sake. The curiosity that leads us to persevere until we have solved a problem or carried a line of investigation to a successful issue is responsible for the great advance in intellectual pursuits.

Curiosity as the motive power in intellectual emotions.

We may note that the pleasurable intellectual emotion comes at the end, or in anticipation of the end, of

the intellectual action. The solution of the problem by the mathematician, the working out of the principle by the mechanic or inventor, may not be pleasurable in themselves. On the contrary, there is often the disagreeable sense of intense strain and effort. The imagination pictures the coming triumph, but for which stimulating force the laborer would often throw down his tools in despair. Generally speaking, too, intellectual emotion does not react so severely upon the physical system as do the others that have been mentioned. One would not expect a person to be so agitated by mastering a problem in geometry as by fear of one's own safety or by sympathy with the suffering of one's friend.

Pleasure comes at end of intellectual action.

The student of the best literature finds his intellectual emotions stimulated in a legitimate fashion by the suggestions of similarity in diversity there presented. When two things never before brought together in the mind are found in juxtaposition, the pleasure resulting is great in proportion to our appreciation of the suggestion of the author.

Literature and intellectual emotions.

If this is true, what kind of literature should give us the best intellectual enjoyment? How may we test the degree of refinement to which our emotional natures have been cultivated? Analyze

Problems.

the difference between the following expressions of the same fact :

> For every wave, with dimpled face,
> That leap'd upon the air,
> Had caught a star in its embrace,
> And held it trembling there;
>
> MRS. WELBY:

—and "The foam sparkled as the waves rolled upon the shore." Can you explain what Lessing meant by saying, "If God should impose the alternative, I would prefer the pursuit of truth to its actual attainment"?

IV. Aesthetic emotions, which may be defined as the feelings, pleasurable or disagreeable, arising from the perception of the beautiful or its opposite.

Aesthetic emotions.

There are several characteristics of aesthetic emotions which should receive our attention. An emotion aroused by beauty must be pure, that is, it must give pleasure without any mixture of the desire for possession, and without consuming the object that arouses it, in order to be aesthetic. The aesthetic emotions are lacking in purpose. There is no idea of future good to be derived from the present object ; we surrender ourselves to the enjoyment of the moment, forgetful of all else besides. The mind seems to be in a passive condition, drinking in the enjoyment. Further, it is an emotion that can be

Characteristics of.

enjoyed with others, a social emotion. In these days we may be expected to call it the unpractical emotion. The enjoyment to be derived from a fine painting, a beautiful landscape, or the soul-stirring charms of exquisite music, has nothing of the "practical" about it, if we use the word "practical" in its modern accepted sense, as "that which conduces to the acquirement of dollars."

Some degree of appreciation of the beautiful is universal.

And yet we cannot entirely rid ourselves of the tendency to appreciate the beautiful things that have been placed in the world for our enjoyment. Every child shows this tendency in his love for the brightest colors; savages show it in their fantastic garb; semi-civilized peoples show it in their crude attempts at artistic ornamentation; and even we, in our "practical," humdrum life, must follow the fashions and array ourselves in becoming clothing; must plant flowers in our gardens and keep our lawns mown.

Problems.

Walking in Central Park, New York City, I heard some one wondering why certain portions of it were not graded, and why the trees were not trimmed into artistic shapes. Did this show a true appreciation of the beautiful? Which is really more artistic, a landscape just as Nature makes it, or one fresh from the hands of the landscape gardener?

Let us analyze the aesthetic emotions into their elements for the purpose of finding out whether they are really valuable or not. In the first place, we find a sense feeling aroused by the action of one or both of the two senses, hearing and sight. This sense feeling may give aesthetic pleasure at once, as when we look upon a beautiful sunset or hear the chimes in the cathedral tower. Aesthetic pleasure through the medium of sensation alone is not, however, of the highest order. Children, savages, and ignorant people enjoy colors in masses, with little regard for the harmonizing and blending of tints. It is only as the senses are modified and controlled by the higher faculties that we learn to discriminate with nicety that which is truly artistic in the highest sense.

Analysis of aesthetic emotions. Sense element.

This discriminative grouping and arranging of the sense elements we may call the intellectual quality. The person with the trained intellect finds more of beauty in the working of Nature's laws than the ignoramus. The cultivated traveler gets far more enjoyment from his journeys than the one who lacks this cultivation, and the same is true of him who enters the workshop or the laboratory.

Intellectual element.

The third element may be called the imaginative, associative, or ideal element. What makes a heap of

ivy-covered stones in Europe more interesting than a similar heap in America? Simply the imagination, which associates the European pile with some well-known event in the past.

Associative element.

Why would you prefer a trip up the Hudson to one up the Missouri? What influence would Washington Irving have over your decision? Why do so many people who live in America prefer to go abroad rather than to travel in our own country, though the scenery in America is finer than any to be found abroad? If this element is necessary in order that we may reach the highest enjoyment, do you see any aesthetic advantages in obtaining a good education? Would we not be just as well off without aesthetic emotions? Why? Do all people think the same things beautiful? Can you tell why?

Problems.

If we should visit any great art gallery, we should be able to find great differences between the schools of painting of different countries and of different centuries. This would show that taste changes. What is considered good taste in America to-day may not be so considered a hundred years hence, nor may it be pleasing to the European of the present. And yet, within certain limits, we may say that the standard of aesthetic emotion, that is to say, of good taste, for any age and country is

Standards of taste change.

set by the intelligent, cultivated people of that age and country.

Under the aesthetic emotions should be mentioned in particular the emotions of the sublime and the ludicrous. The feeling of the sublime is excited by that which is beyond our power to grasp, by the vast, infinite, incomprehensible. If you stand on the shore of the ocean and look off over its surface, you will probably experience this emotion. The sense of sight is filled full, and you have the feeling of the immensity of the beyond. The same feeling comes if you lie on the ground and gaze up into space. Just think of God, the Being of infinity!

Emotion of the sublime.

Directly opposed to this feeling of sublimity is the feeling of the ludicrous, which arises from littleness, incongruity, grotesqueness. Under the ludicrous come the different forms of wit and humor.

Feeling of the ludicrous.

In wit there is always the sense of superiority. The person at whose expense the laugh is raised is made to appear small, of little account. Wit is thus often personal, and is apt to have a keen edge and a sharp sting.

Wit.

Humor, on the other hand, arises from the incongruous or grotesque. It has a kindly element in it, and does not give pain.

Humor.

V. Moral emotions, which, though containing the elements of all the others, are yet distinct, separate, and peculiar in their power. To begin with the end toward which moral emotions are directed, we find that they deal exclusively with human actions. The perception of the beautiful in nature or the human form may arouse an aesthetic emotion, but not a moral emotion, because there is no distinction of right and wrong in them. That is to say, the moral emotion becomes a judge of the rightness or wrongness of actions. The actions of the lower animals can have no moral quality, can arouse no moral emotions in us, because their actions have nothing of the right or wrong about them.

Moral emotions.

Even in the judgment of human actions our moral emotions are modified by the circumstances attending the actions. Moral actions must be willed. If there was no choice in the act, we can pronounce no judgment of its rightness or wrongness.

Moral emotions modified by circumstances.

A man driving through the street of a city loses control of his horses. In their mad rush through the street a woman is struck and killed. What is our moral verdict upon the action? Suppose, however, that the driver was careless, that he took the middle of the street and turned neither to right nor to

Problems.

left, nor slackened his pace for anything. Then, though his horses were under perfect control, what would be the moral verdict if any one should be injured? Does this illustration show that moral emotions are modified by the disposition or intention of the person who commits the willed action?

The moral feeling acts, not only in a judicial capacity, pronouncing the verdict of right and wrong upon actions committed by human beings in their relations with one another; it also acts in an executive capacity, regulating the conduct by the mandate of its "ought." In this capacity it rises above any of the other emotions thus far considered. They, so far as they influence conduct, one and all attract us to that which is pleasurable, away from the disagreeable and the painful; this leads us in the path of duty, even though in the performance of that duty we may suffer the most acute pain. For any dereliction in duty, for any act that is judged to be wrong, the moral feeling makes us suffer the pangs of remorse. Thus we find moral emotions occupying an important place in our experience. We deliberate upon a course of action and determine whether to enter upon it or not by our estimate of the effect upon our moral nature.

Moral emotion executive as well as judicial.

Under moral emotions are conscience and religious

emotion, the discussion of which is the proper subject of ethics.

How did moral emotions develop?

We may be asked how the moral emotion, so different in character from the others, came to be developed in the human race, and we may not be able to give a very satisfactory explanation. Some have said that it is the direct outgrowth of egoism. When primitive man found himself arrayed against the wild beasts, he made the discovery that he could ward off their attacks more effectively by allying himself with his fellows for mutual protection. The more he diverged from the "golden rule" in his treatment of his allies, the more danger he incurred. In this way his duty, what he *owed* to his neighbor, became a fixed idea.

Other theories.

Others have maintained that God has planted in man a special faculty, conscience, to act as the arbiter between right and wrong. Still others claim for the moral emotions a source in instinct, and so on.

Standard continually raised.

Whatever we may think about the source, which is a matter of speculative interest only, we may be thankful that every one has some moral feeling, and that, though the standards of morals may change as the ages roll on, the normal level is being continually raised, so that the race is gradually

being educated up to a broader moral plane which does not permit of human slavery or religious persecution.

With a word about the effects of emotions, we will leave this division of the subject. Nothing is more conducive to bodily health than a healthy emotional state. The joyous emotions act upon the body as a tonic. On the other hand, grief and its congeners kill. We all know that severe physical pain produces a collapse of bodily vigor, even an hour's suffering leaving the victim limp and powerless. The emotions of anger, fear, and grief react upon the nervous system in the same way.

Effects of emotions.

A professor of history during my college days used to say: "Man is an accursed animal. You can never tell which way he is going to jump when you touch him." The latter part of the statement is certainly true, and it is true because we can never tell just what emotion will get possession of a man at any time and under any given circumstances. This study of emotions through actions constitutes one of the chief charms in the study of history. There is generally a conflict of emotions raging on the battlefield of the mind, and the action is determined by the victorious emotions. The pages of history, biography, and fiction are covered with the struggles between emotions which we allow to influence us and which we

Application.

judge to be right or wrong. Study the characters of Shakspere, for example, as Othello and Iago, Macbeth and Hamlet. The conflict between jealousy and love, envy, hatred, and ambition, ambition and friendship, self-pity and duty, is set forth with marvelous skill and clearness.

The next time you wish to do something, but find yourself hesitating before you do it, examine into the conflict of emotions that is going on within you.

CHAPTER XII.

WILL.

THE third great function of mind is willing, and it may be necessary, at the outset of our examination into the action of the will, to show how voluntary action is different from intellectual action on the one hand, and from emotional action, or feeling, on the other.

The will.

It used to be the custom to say to the student who reached this point: "Now, you know what the intellect does, and you know what the sensibility does. All in human experience that comes under neither intellect nor sensibility must belong to will." While this is undoubtedly true, it hardly satisfies the student. We wish more positive information on the subject. The first thing that we find to be true is that the great subject which we have not yet investigated is *action*, and we may remember that the will concerns itself with action. We are all the time acting or not acting, as a result of willing to act or not to act. Every one knows just how it works. Illustrate from your own experience.

Definition of will.

But action may be one of two kinds — conscious, and unconscious or reflex. Of course only the former can come under the influence of the will, and yet we must believe that conscious voluntary action is developed from the lower or unconscious action. Watch the movements of the infant. At first his bodily movements are not directed, nor are they the result of conscious experience. We must, then, in considering the development of the will, begin with these undirected reflex actions.

Conscious and reflex action; latter developed from former.

Let us discriminate between intellectual action and willing, for which purpose the following illustrations may suffice. You sit in your chair so busily engaged with the contents of your book as to be oblivious of all around you. Suddenly some one shouts your name. You jump from your chair. Was that an action of the will? No; for had your will been active, you would not have stirred. On the other hand, during the silence of the night you wake from a sound sleep. A slight noise is heard. You raise your head from the pillow and strain every nerve to hear what is going on in the house. When the attention is aroused, the will becomes active.

Intellect and will.

Give other examples to illustrate the difference between intellect and will.

Problem.

What is the difference between feeling and will? Here again the point may be made clearer by an illustration. I hear that an earthquake shock has been felt in Japan, and that the homes of hundreds of people are in ruins. "I am so sorry for those poor people," I say, and there the matter probably ends. My next neighbor falls from the fourth story and is killed, leaving a widow and several children in destitution. I start out at once to render them all the assistance in my power. I furnish them food; I try to interest my friends in them.

Feeling and will.

Do you see any difference between the two cases? Point it out. The new element in the second case is will.

Problem.

We may define will positively, then, as the power of action resulting from intellectual and emotional processes. It is the will that brings about results in the world. A person might have an intellect of the highest power and the finest sensibility of which a human being is capable, and yet, without the directive action of the will, he would never accomplish anything either for himself or for others. It will be interesting to discover how this power is developed.

The will: what it is and does.

In the first place, we have already found that, in order to study will, we must study action. Why?

Problem.

But, in order to get at the foundations of these manifestations of will, we must take the simplest kind of action. If we notice the movements of the infant, — his throwing about of the hands and his kicks, — it is difficult for us to believe that he does these things because he wills to do them. These movements, though there may be an instinctive element in them, we may call random movements. And yet it is right here that we must begin to study the development of will. The child finds that a pleasurable sensation arises from these random movements. His happiness is much increased thereby.

Point of departure in study of will.

Random movements.

Now, what would be the most natural thing under the circumstances?

Problem.

This is just what happens, and we find the first conscious volition resulting from random experience. We may say that the cause of these random movements lies in the condition of the nervous system; and then we have the continuous chain of mental experience from the beginning, just as it was explained in the first chapter.

Source in the nervous system.

We should avoid falling into the error of supposing, as some students of the subject have done, that the earliest, or random, movements have in themselves

any trace of volitional action; nor, on the other hand, should we go to the other extreme and maintain that it is only when the child's instincts are aroused to action that we can begin to trace the development of volitional processes. The matter of itself would seem to be of little importance, but the student of physiological psychology, or psychology from the physiological standpoint, generally leans toward the former, while the purely psychical student leans toward the latter error.

Possible errors in giving too much or too little importance to random movements.

The name "unconscious reflex actions" has been given to these random movements to distinguish them from the higher forms of movement in which consciousness begins to play some part, however slight. Illustrations may be given to make clear the distinction between unconscious and conscious reflex action. A familiar example of the former kind, but one which we may not care to try, is this: a frog has been decapitated. Of course the seat of the frog's consciousness has been removed with his head. If a drop of acid be placed upon the side of the body, the feet will perform the movements necessary for the removal of the irritating substance. Such movements can be nothing but reflex. We can hardly place a human subject

Unconscious and conscious reflex action illustrated.

under the same conditions, but we can experiment upon him when consciousness is dormant if we take him in sleep.

What causes the sleeper to move the hand that is touched? Here we have a case of reflex action

Problem.

without the interposition of consciousness. Can you give other examples?

An example of conscious reflex action may be secured by performing the same experiment given

Conscious reflex action.

above upon one who is engaged in reading or study. Advance the point of a pencil quietly until it just touches his finger. He will withdraw the finger at once. The movement will still partake of the reflex nature, but the subject will be dimly conscious of what is going on. In both of these instances there is a lack of the directive force of the will, and yet one differs from the other in the alertness of the consciousness.

Differing from these random reflex movements are those which we call instinctive. Here there is a com-

Instinctive movements.

plication and variety, from the simplest class of actions, such as throwing out the hands when falling, or the chasing of the mouse by the cat, to the intricate series of movements performed by the beaver in building his dam, or by the bird which builds its first nest. There are two peculiarities about

instinctive actions: first, their origin; and, second, the fact that they are directed toward some definite end.

Let us study the beaver, for example, in which case we shall find both of these peculiarities illustrated. The young beaver starts to build his dam by selecting the proper place in the stream, clearing away obstructions, cutting down and drawing the necessary wood; after all of which preparations he places everything in position and fastens it there. Now, the young beaver builds his first dam with just as much skill, and apparently with as little effort, as any succeeding one. Why is this? You answer at once, *Instinct*, and you are right. Instinct prompts all these actions. But who can tell just what instinct is? If you consult the dictionaries, you will probably learn that it is a blind impulse to action directed toward some intelligent end; but I hope you will not be satisfied with that. If you read books on natural history, you will learn much about this wonderful power "which God has placed in animals to a much more marked degree than in man," and you may conclude, as many others have done, that these animals are superior beings. But let us not be too hasty in drawing our conclusions. True, God has given these animals a wonderful power, but He has made this power dependent upon the physical nature of the animals. In

Instinctive action of the beaver.

other words, God has given these animals a nervous system; and instinctive action is but a third and higher form of reflex action in response to an impulse from within.

Explanation of instinctive action.

The beaver builds his dam because he cannot help it, his nervous system being so constituted as to force him to act in certain ways under the influence of certain stimuli. He needs no education, for the laws of his action are fixed; and he needs not to reason, for the same cause.

Give examples of instinctive actions from your own observations on the dog, the cat, the hen, birds, etc.

Problems. Notice that all these instinctive actions seem to have a distinct purpose, but that the end to be attained is unforeseen.

Do instinctive actions involve memory?

The question has often been asked whether, after the first experience, there might not be in later actions a memory of the results obtained before, which might serve as a motive. For example, does the bird that flew south at the approach of last winter hold in memory that experience, and, when the next frost comes, will she make use of that remembered action in determining what to do? The answer to this question is, undoubtedly, no. It may seem unreasonable to suppose that

a hen, having hatched out one brood of chickens, has no objective idea of the chickens to come by sitting on another nest of eggs; and yet the supposition that she has the chicks definitely in view, besides being opposed to the fact that she will sit on one china egg just as assiduously as on a nest full of real eggs, involves so much more than memory that we can hardly call it tenable.

Method of studying instinctive action.

Our only means of learning anything about the instinctive actions of animals, more than the mere observation of those actions would tell us, is by observing our own instinctive actions and analyzing our own feelings and mental processes.

Example of human instinct.

Take a case that very often occurs. A young mother sits in the parlor. Suddenly she hears a sound coming from the nursery. She at once starts up and goes to her infant. The maternal instinct draws her. She finds the child sleeping peacefully and returns to her chair. Presently she hears another sound. Again she goes to the nursery to see whether the child needs her attention. Now, why did not the remembrance of what happened in the first instance deter the young mother from acting in the second? Simply this: the maternal instinct told her that the infant would need her

attention if awake. She heard a sound that might indicate that the child was awake, and her physical system responded to the stimulus thus presented — no memory, no reasoning about it.

The origin of instinctive action is, then, in the physical constitution of the animal, which causes him to act in certain ways responsive to external or internal stimuli. The end of these actions may be immediate or remote.

Origin of instinctive action.

In the purposive tendency of instinctive actions we find ourselves bordering closely upon the voluntary acts of the human being; and yet it is a long step from the blind response to a physical stimulus to the rational plan of volitional action. Wonderful are the results of instinctive action, but they are wonderful only because the rational faculty has no share in them.

Instinct approaches volition in its purposive tendency.

Moreover, because we are in the habit of studying instinct in the lower animals, should we conclude that we are without instincts? Have we many instincts, or have they been trained out of us? Professor James says, "No other mammal, not even the monkey, shows so large a list." Try to form a list of the instincts that develop in children.

Human instincts. Problems.

If Professor James' statement is correct, and by the

time you have completed your list you will agree with him, why is it that instinct appears to play so small a part in human life? In answer to this question two principles may be given. Instincts are not necessarily permanent. If the proper action is for any reason prevented when the instinct begins to develop, the instinct itself is held in abeyance or altogether destroyed. Again, instincts may be prevented from developing by habits already formed as the result of earlier instincts. Every act tends to become habitual, and after the habit is once formed, it is a difficult matter to break it off for a new one. We, with all our mental powers, find it difficult, but to the lower animals it becomes well-nigh impossible.

Why do instincts play so small a part in human life?

Numerous experiments have been made to establish the truth of these principles. In order to keep the succession of events clear, it is necessary to experiment upon animals that arrive at maturity quickly. Make some investigations for yourself. Examine, for instance, into the following instinct of some animal. We know that this instinct is developed in the dog. Has the cat the same instinct? Can you teach a kitten to follow you just as you can a dog? Can a chicken be taught to follow you just as it follows the hen?

Experiments in developing instincts.

Now, all these movements or actions — reflex, impulsive, instinctive — are to serve as the foundation for the higher exercise of volition, and in the following manner. These movements, which are unacquired, are observed by the active consciousness. The personal factor is here introduced. The mind is ever on the watch for materials, and in these movements it finds them. Furthermore, the mind not only observes the movements, but it also observes the effects of the movements upon the physical system, and so upon itself.

All the foregoing are preparatory for voluntary action.

The pleasure resulting from certain movements is retained, and the representative faculty brings it forward as an image again and again until a desire is formed. Desire sets into action the motor impulses necessary for the attainment of the desired end, and we have volitional action resulting. It remains for us to consider this highest type of volition, the new elements in which are desire and volitional action.

Transition to voluntary action.

Desire is always for something. The child may desire candy, because of the anticipated pleasure that it will give, or it may desire relief from the pain consequent upon eating too much. In either case the desire is a positive longing for something, and in both cases it is for pleasure. Desire is

Nature of desire.

always accompanied by some idea of the object ultimately to be attained. In this respect, how does it compare with reflex and instinctive action?

Desire and attention.

So materially affected by the power of attention is it that many psychologists maintain that desire is only a variety of the attentive power. This may show how closely desire is related to the purely intellectual processes through attention. Attention is, then, a very important factor in desire.

Example.

For example, let us suppose that I have received a present of a sum of money to spend as I choose. Immediately I begin to think over the things that I would like to have and to do. Being of a studious turn, I may want to increase my library; having a taste for art, I find here an opportunity to gratify my taste in the purchase of pictures, and so on; or I may take a long-needed rest and enjoy a vacation trip. The question is, Which of these things do I desire most?

Ability to regulate the desires.

As a matter of fact, I can cause the desire for any one of them to become more powerful than the others by simply centering my attention upon it. This will throw that particular object of desire into the foreground, and its prominence will tend to magnify its desirability until the others will sink into comparative insignificance.

An interesting subject for investigation right here is this: Is it possible to determine beforehand which one of the several objects of desire will probably gain the ascendency? We may predict with certainty that a desire will be strong or weak in proportion to the amount of pleasure anticipated in the gratification; that is, the representative faculty introduces the determining element. Do not understand, however, that we shall always act according to the strength of the desire in the sense just indicated. I may decide to give the money presented to me to relieve the distress of my indigent neighbor. In this case the gratification of the altruistic feelings gives more prospective satisfaction than anything that I could obtain for my own private pleasure. In a broad sense, the statement that our action will be determined by the strength of our desire is true, but before we could tell which object of desire will result in action, it would be necessary for us to know all the antecedents, environments, and consequent habits of the person.

Can we determine beforehand which desire will predominate?

Antecedent to desire is a representative idea. Passing through the country, I see ripe apples on a tree near the road. I desire one to eat. Why? Because the sensation produced by the sight of the apples has set in motion a train of images.

Representation and desire.

In my mind I taste the apple, which gratifies my appetite; my nervous system acts upon my mind so powerfully that a desire is aroused. This desire, when analyzed, will be found to possess two distinct characteristics: (1) a feeling of pleasurable anticipation; (2) a conscious tendency toward the gratification of the feeling, which will easily result in action. The idea thus becomes an active force by sending its message along the motor nerves.

Tendency of motor ideas to result in action.

But what of those actions which are imitative in their nature, and why does not action follow every motor idea? It may be seen readily that, unless something intervenes to prevent, all motor ideas would at once resolve themselves into actions.

Illustration.

An illustration first given by Professor Huxley, and which has been used by many other psychologists, will bear repetition here in a somewhat modified form, because it brings out the idea so clearly. A discharged soldier was walking to his work one morning, when one of his friends, who liked to play practical jokes, shouted, "At*ten*TION!" Instantly the ex-soldier assumed the proper attitude, dropping his lunch basket, the contents of which rolled in the dirt. The suggested idea brought the usual responsive action. The man had been thoroughly drilled as a soldier, but

he would have been a far better soldier had he not responded to this particular call. Why?

Why do we find it easier to trust people who always do what they know to be right? How can we develop

Problems.

the power to control actions that have become customary in response to certain motor ideas? Shall we conclude that habit may act to modify the strength of desire?

Why will a child prefer a small, comparatively trivial object, if he can have it at once, to a much more valu-

Problems.

able object to be delivered a month hence? Explain the psychological meaning of "A bird in the hand is worth two in the bush."

Imitative actions.

We often find ourselves imitating the actions of other people when we are interested in what they are doing. If we are habitually in the company of a stutterer, we shall soon find our own tongues halting over common words. The idea is suggested to our minds, and, our consciousness not being on the alert, the appropriate responsive action follows. Imitative actions do not reach the high level of willed actions. The higher orders of the lower animals, such as the monkey, furnish us the best examples of imitative actions, along with small children and those whose mental faculties are weak or altogether lacking.

When the child obeys his parent or teacher without question, when the soldier obeys the orders of his commanding officer promptly, how are these actions related to imitative actions?

Problem.

It was said in the beginning that desire goes forth toward some definite end. Many of our desires, however, are mere passing fancies. In proportion as our will is trained we put these wishes aside, and thus develop the highest form of desire — motive. Motive is the educated desire for that which is attainable. Even here there is a reactive force, for the will may, by concentrating the attention upon any one of a number of attainable things, make that one thing the object of special desire. So it happens that, while motive constitutes an important element of executive volition, the will develops and controls the motives.

Motive as the highest form of desire.

Which of the objects of desire shall become the motive impelling us to act? At this point the intellectual factor in willing appears. My vacation is approaching. How and where shall I spend it? I desire a change of air and scene. Before I go anywhere, I look up the different places that will give me what is desired.

Intellectual element in desire.

Then, before deciding upon any one of them, I compare them carefully, weighing their respective merits

and demerits, referring each to my limited means to ascertain whether I can afford to spend my vacation there or not. Before I finish my deliberations, I am almost ready to give up the trip and remain at home.

Deliberation.

But the need of some change urges me on to the next step in executive volition — decision or choice. The choice between the alternatives presented cuts off the deliberation. The very act of choosing or deciding shows that there are at least two alternatives, and that these alternatives disagree with one another in one or more respects.

Decision or choice.

In every voluntary act we find ourselves confronted with this necessity of choice. Sometimes we come to a decision at once without due deliberation, and then we are apt to regret it. Many a life has been wrecked by such hasty decisions. At other times we neglect to decide, continuing to deliberate until it is too late to influence the event whether we decide one way or the other. This deciding by refusing or neglecting to decide is apt to be just as fatal as hasty decision.

Constant necessity of choosing. Hasty choice. Choosing by not choosing.

We are constantly choosing. I look out of my study window and am confronted with the necessity of a choice. Shall I look at the houses, the trees, the passers-by, or at the hills

Constant choice and the effects.

and the river in the distance, or shall I let my gaze wander lazily from one to another of these objects? What I see will depend upon my choice; and so we go through life constructing a little world of our own, broad or narrow, just as we choose.

Freedom in making decision.

In all these choices there is another element besides the attractiveness of the alternatives presented, namely, the consciousness of perfect freedom in making the decision. I look at the hills and the river, but I know that I could look at any of the other things if I preferred. This is not the place to give the arguments for and against the freedom of the will. It is sufficient for us that we know that in every act of life we might have done something else had we so chosen. The pages of literature are filled with examples of decisions, wise and foolish. We judge of the characters in books and of the people about us by the nature of the decisions that they make, because choices lead to the complex voluntary action that we call conduct.

Conduct the resultant of all mental forces.

Conduct, the last step in willing, sometimes called executive volition, is the active element, the result of all the gathering of knowledge elements by the senses, the perceptive and representative processes, including imagination and thought, feeling and emotion. All these combined

forces have for their object the modification and direction, the stimulation or repression, of conduct.

Resolutions should be carried into actions.

Even deciding to do a thing is valueless unless it is carried out into action. In our times, especially, we want people who act. Those who talk glibly, who seem to feel deeply, and who declare their resolutions to accomplish great things, can be spared much better than a single one who goes ahead and proves his intentions by doing something. There is a letter that should be written this morning. You resolve to write it, but the morning passes, and the letter remains unwritten. You know that you ought to learn to-morrow's lessons this evening, but after tea you take a short stroll, fall in with two or three friends, and soon the evening is gone and the lessons are not learned. Perhaps you remarked several times that you had determined to spend the evening in study. So much the worse for you! It is an old saying, "The road to hell is paved with good intentions," which, had they been carried out, might have made stepping-stones toward heaven.

Analysis of conduct and control of conduct.

Since conduct is of so much importance in life, we may well analyze it and find out, if possible, how it may be developed in the right direction. We need hardly notice simple actions further, but may devote our attention to courses of action,

the ends of which are more or less remote. Why do we spend years in the study of subjects, many of which we are quite sure will be of no "practical" value to us in life? The correct answer will probably suggest itself.

The first element in the control of conduct is intellectual. The representative power places before me images of the pleasures and advantages that will accrue from the present toilsome processes. At the beginning of my life as a student these images were but few in number and weak in power. Consequently, I needed the guidance of a stronger hand and a superior wisdom — one that could represent for me in so far as my own images were not clear. The object of my teachers in those early years was, or should have been, to induce me to lay the broadest possible foundation, upon which my own representative powers would gradually take increasing pleasure in building for themselves.

1. Intellectual element.

What kind of teachers should be placed in charge of the primary departments of our schools?

Problem.

As I grew older and kept on studying, the images increased in number and vividness until I no longer needed the stimulus of outside direction, these images themselves furnishing all the motive required; and I became a self-directing student,

Self-direction attained.

ready to keep on with my work for an indefinite period in order to reach the goal which had become my ideal.

Thus, the second element in conduct comes to be emotional, as the images of future good grow more and more attractive. In my early childhood I could easily be led to look upon present gratification as more desirable than any future advantages, because my mind had not attained the power of concentration; my self-directive force was weak, and although I had, in a general way, a desire to become a definite something when I grew to man's estate, I had not the resolution, the firmness of will, to steer my course steadily through the means leading to that end. Here, again, was the need of teachers and wise guides apparent.

2. Emotional element.

The third element needed for any course of action extending over any length of time is this directive power — the power of inhibition, as it is scientifically known. It is this power that keeps us in the right road, that puts aside, as really inferior to the main thing in view, all desires that tend to draw us into bypaths, however attractive they may temporarily seem to be. But for this inhibitory power every motor idea would work itself out into its customary action.

3. Inhibition as element in conduct.

Inhibition is the power that enables one idea to

control and divert to its own advantage the usual action of another idea. It will be seen at once that this power is itself complex, containing elements of memory, deliberation, and choice.

Inhibition defined.

Compared with the other powers, inhibition is developed late. Children do not possess it. In many — too many — instances it seems always to be weak and uncertain.

Developed late.

Give examples showing different stages of the development of this power from observations of a domestic animal, as the dog or cat, children, people without culture, and those who have received the advantages of superior training. Do the results of your observations warrant you in making any statements about the value of education in controlling conduct? Matthew Arnold says that conduct is three-fourths of life. Do you agree with him?

Problems.

A few words concerning the development of self-control, which is the aim of education and almost synonymous with an educated will, are necessary to make our survey of the subject complete. We must avoid the mistake of thinking that the different faculties are developed one at a time. Mental development is a unit. As we educate the powers of observation, gathering in the raw material

The mind develops as a unit.

for the mind to work upon, we are at the same time forming and increasing the power to image, to think, to feel, and to will.

Will potential in childhood. Muscular control first step in development.

In childhood the will is a potential force. The first step in its development consists in gaining control of muscular actions. This, in itself, is no slight task. The young of the lower animals find themselves at once possessed of the power of coördination which the child has to spend many a weary day in acquiring. Then, too, think of the hard time he has in learning to write, to swing Indian clubs, to play the piano. It is a severe strain upon the young will to persist until these and kindred arts are mastered.

Control of feelings second step.

The second step comes when the child learns to control his feelings. This is harder than the first, for there is the added psychical difficulty to overcome. As the child comes in contact with his fellows in games, etc., he finds that it is not good policy to give free vent to his feelings. He is jeered at and tormented if he does. It is a hard lesson, but he soon manages in the school of experience to control the expression of his feelings, and gradually, if rightly influenced, to control the feelings themselves. Occasionally, of course, there will come uncontrollable fits of passion, but with ever-decreasing frequency, until, so

far as appearances are concerned at least, the feelings may always be as calm and tranquil as a summer sea.

The third step is the control of ideas, which is most difficult of all. As already hinted, it is gained through the attention. At first the attention is involuntary, attracted now this way, now that, as the different stimuli act upon it. Gradually the will forces one idea to the front and another to the background, and keeps them there.

Control of ideas third step.

Are we responsible for the thoughts that come into the mind?

Problems.

> Who has a breast so pure,
> But some uncleanly apprehensions
> Keep leets, and law-days, and in session sit
> With meditations lawful?
>
> "Iago" in *Othello*, Act III, Scene III.

"We cannot prevent the birds from circling in the air above us, but we can prevent them from making their nests in our hair"; and so it is with thoughts. If we harbor a thought, allowing it to make a nest for itself in our mind, it becomes a part of us. Much, therefore, depends upon our ability to control our ideas.

We may, to a certain extent, control our beliefs. It has been said that a person who repeats a falsehood every day for a year will, before the end of the year, believe that he is speaking the truth. The person harbors the false notion, allows

Control of beliefs.

it to become a part of himself, counts it as truth, and establishes it among his beliefs.

There is a constant tendency on the part of the higher acts of will to lapse into lower forms. An act often repeated soon begins to lose much of its voluntary character as it becomes habitual. The formation of correct habits, then, has much to do with self-control.

Tendency of higher to lapse into lower volition.

Character (χαρακτήρ = stamp) is sometimes defined as a bundle of habits. In habits there are three controlling principles: first, heredity. We may have inherited from our ancestors a tendency to form certain habits. The habits themselves can never be inherited, and may be prevented from ever showing themselves if the other controlling principles are properly attended to. If you have a bad temper, for example, do not lay the blame on your ancestors, who, no doubt, had faults enough of their own without assuming the responsibility for yours.

Three controlling principles in habit: 1. Heredity.

Second, the surroundings, or environment, have much to do with the habits formed. The boy or girl brought up in the midst of vice and cruelty cannot be expected to form the same habits as the one whose home surroundings have been all that could be desired.

2. Environment.

Third, the will, which may enable one to rise above hereditary tendencies and above environment, is the most important factor of all.

3. Will.

How far may we control the determinants of habit?

Now, how far may we control these determinants of habit, and so the habit itself? We cannot choose our ancestors, but we may exercise a measure of choice in our surroundings. People have always been doing that.

Problems.

How did Shakspere, Benjamin Franklin, etc., illustrate this power? Can you logically argue from such examples that the city affords better opportunities for cultivating good habits than the country?

Control of will.

We may also control our own wills through the processes of deliberation and choice. The higher forms of happiness come only through the consciousness of power—power over one's self, power to choose. More than this: the greater the number of alternatives from which we may choose, the more real pleasure there is in the choice; and nothing gives this greater variety but education. The young college graduate has before him many alternatives. All the professions are open to him, as well as every avenue of business. On the other hand, the uneducated man finds himself shut out from all but a few avenues for his life's journey. The more things we can do, and do well, the more satisfactory life becomes.

Problem. How much truth is there in the line, "Where ignorance is bliss 't is folly to be wise"?

Method of forming habits. If you wish to form a habit, you must observe two rules. Use your will power to force the idea to a prominent place in your mind and keep it constantly before you. Put aside all that may distract your mind until you have the desired habit well under way. You must be constantly on the alert to do or not to do. The student who stays at home from school because it might storm, or in order to practice her music lesson, or to attend the matinée, will never amount to much educationally unless these bad habits are displaced by good ones. It is not a bad practice, for the development of the will, to do something that you don't want to do each day. Force yourself to do something that you do not like to do, — something that is worth the doing, — and you will find your character developing, the stamp becoming deeper than before, until the ultimate object of education — perfect self-control — will appear to be among the possibilities of attainment.

INDEX.

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SOLUTIONS, ANSWERS, NEW PROBLEMS.